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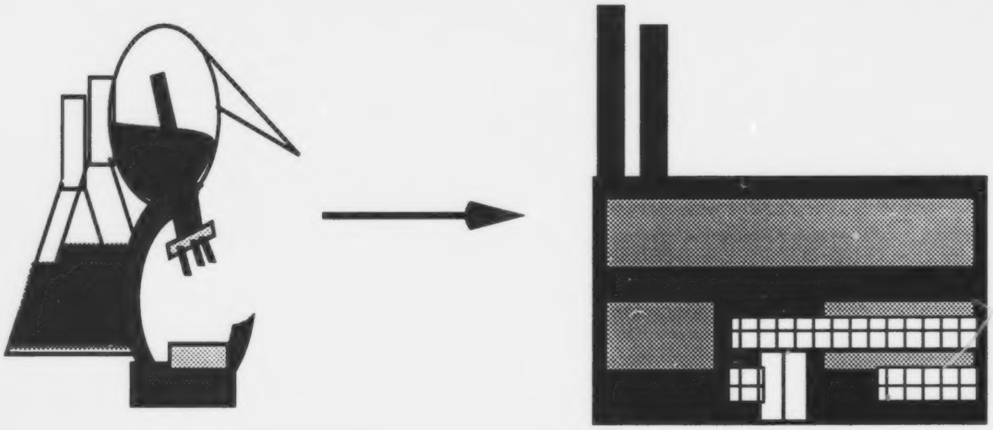
Report And Recommendations Of The Technology Innovation And Economics Committee

Permitting And Compliance Policy: Barriers To U.S. Environmental Technology Innovation



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To the Reader,

This report represents the first comprehensive attempt to investigate in depth one of the major barriers to encouraging both innovation and diffusion of technology important for achieving better environmental control and quality. Permitting and compliance policy, up to now a major barrier, needs to be refocused towards these goals. In issuing this report, the National Advisory Committee for Environmental Policy and Technology (NACEPT), through the efforts of its Technology Innovation and Economics Committee (TIE), has adopted a series of recommendations to bring about significant changes in federal environmental policy.

We would like to thank EPA's Administrator William K. Reilly and NACEPT for giving the TIE Committee the direction to undertake this study, and all those in industry, federal, state and local government, academia and the environmental community who provided information and perspective at Fact Finding meetings, in presentations, and through other mechanisms. The Focus Group that prepared this document deserves the highest commendations for its contribution of time and effort, its thoughtful deliberations, and its creative and challenging recommendations. In particular its chair, Ed Keen, and David Berg should be recognized for their outstanding leadership and staff support.

This Report and Recommendations proposes a necessary and comprehensive reform of environmental permitting and compliance systems. The implementation of these recommendations will encourage the development and commercialization of innovative technology for environmental purposes.

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The United States' potential to improve the environment is directly related to the nation's ability to produce and apply technological solutions. The Technology Innovation and Economics (TIE) Committee, a standing committee of EPA's National Advisory Council for Environmental Policy and Technology (NACEPT), concluded that the barriers in federal and state environmental permitting and compliance policies are slowing technology innovation for environmental purposes. This extensive study, involving technology developers, technology users, financiers, regulators, environmental groups, and academia, determined the range of impacts and identified the range and practicality of potential solutions. The report captures the Committee's analysis of six critical policy issues and the key parameters affecting the design of permitting and compliance systems. It recommends five major areas for improvement, including:

1. Modifying permitting systems to aid the development and testing of innovative environmental technologies
2. Implementing permit processes to aid the commercial introduction of innovative technologies
3. Encouraging the use of innovative environmental technologies in compliance programs
4. Maximizing the effectiveness of permitting and compliance improvements by supporting stakeholders
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NOTICE

This report and recommendations has been written as a part of the activities of the National Advisory Council for Environmental Policy and Technology (NACEPT), a public advisory committee providing extramural policy information and advice to the Administrator and other officials of the Environmental Protection Agency (EPA). The Council is structured to provide balanced, expert assessment of policy matters related to the effectiveness of the environmental programs of the United States. This report has not been reviewed for approval by the EPA and, hence, the contents of this report and recommendations do not necessarily represent the views and policies of the EPA, nor of other agencies in the Executive Branch of the federal government, nor does mention of trade names or commercial products constitute a recommendation for use.

ABSTRACT

The United States' potential to improve the environment is directly related to the nation's ability to produce and apply technological solutions. The Technology Innovation and Economics (TIE) Committee, a standing committee of EPA's National Advisory Council for Environmental Policy and Technology (NACEPT), concluded that the barriers in federal and state environmental permitting and compliance policies are slowing technology innovation for environmental purposes. This extensive study, involving technology developers, technology users, financiers, regulators, environmental groups, and academia, determined the range of impacts and identified the range and practicality of potential solutions. The report captures the Committee's analysis of six critical policy issues and the key parameters affecting the design of permitting and compliance systems. It recommends five major areas for improvement, including:

1. Modifying permitting systems to aid the development and testing of innovative environmental technologies

2. Implementing permit processes to aid the commercial introduction of innovative technologies

3. Encouraging the use of innovative environmental technologies in compliance programs

4. Maximizing the effectiveness of permitting and compliance improvements by supporting stakeholders

5. Identifying and removing regulatory obstacles inhibiting innovative technologies for environmental purposes.

The report concludes that fundamental changes to the environmental regulatory system will also be needed to create incentives encouraging the process of technology innovation.

TABLE OF CONTENTS

Note to the Reader

I. Executive Summary 3

II. Members of the Technology Innovation and Economics Committee 18

III. Introduction 20

- A. Background 20
- B. TIE Committee's Goals and Process 22

IV. The Stakeholders Speak: The Findings 26

V. Rationale for System Changes 41

- A. Analysis of Six Issues 41
- B. Parameters 48

VI. Recommendations for Action and Commentary 51

- A. Executive Summary of Recommendations 51
- B. Detailed Recommendations for Action and Commentary
  - Recommendation 1: Tests and Demonstrations 52
  - Recommendation 2: Early Commercial Use 66
  - Recommendation 3: Enforcement 80
  - Recommendation 4: Support 85
  - Recommendation 5: Regulatory Glitches 96

Appendix 1: Presenters at Fact Finding Processes

I. EXECUTIVE SUMMARY

The Need for Innovation

The United States' potential to improve the environment is directly related to our ability to produce and apply technological solutions. The Technology Innovation and Economics (TIE) Committee concludes that a national strategy is needed to enhance our capacity to produce and use technological solutions that reduce high priority environmental risks, particularly in concert with improvements in the nation's productive capacity.

The increasing complexity and competition in our economy and the growth of human populations make the challenge to improve environmental quality a continuing and uphill struggle. As seemingly finite resources diminish, the pressure to satisfy basic human needs and wants creates demand for advanced processes of production. Yet, opportunities to improve economic productivity often seem in conflict with measures to improve the environment.

The need is growing for advanced scientific gauges of the nature and degree of public health and environmental risk, and for innovative technological solutions to evolving environmental problems. The TIE Committee supports EPA's emphasis on the measurement of risk and the reduction of significant risks as setting an important new standard for the targeting of environmental protection programs. But the rate of technology innovation for environmental purposes is less than required, creating a gap between our ability to define risk and target environmental problems, and our ability to solve them. Moreover, innovators of both manufacturing and environmental technologies frequently operate independently, reducing our ability to simultaneously reach economic and environmental goals.

Strong, predictable, and consistent enforcement of existing regulations, reinforcing the impact of those regulations, defines the market for environmentally relevant technology. On the other hand, the rate of technology innovation for environmental purposes and the policies of the environmental regulatory system constitute a "cycle of constraints." Environmental regulations, regulatory and administrative processes, permit systems, and enforcement practices directly impact the nation's ability to produce innovative technological solutions. At the same time, the rate of technology innovation limits the range of policy options available to the nation's political, environmental, and economic leadership. Environmental regulatory systems thus impact the rate and type of technology innovation for environmental purposes by fostering or constraining the innovation process. This report examines the relationship between the key regulatory administrative processes for implementing environmental regulations -- permitting and compliance policy -- and such innovation, recommending critical steps that should be taken now to foster innovation.

Dysfunction in the Market for Innovative Environmental Technology

Accelerated development and commercialization of innovative technology for environmental purposes is necessary to improve environmental quality and enhance economic productivity.

Our progress over the past 20 years in protecting human health and the environment has been enabled by the development and deployment of improved technologies for pollution control and pollution prevention. To sustain a balance between environmental and economic objectives, technology innovation for environmental purposes will have to continue and increase. *EPA information shows, however, that for at least the past decade the rate of investment in environmental technology development and commercialization has lagged.* This lag reflects a net disincentive for technology innovation for environmental purposes. The TIE Committee of NACEPT concludes that this net disincentive persists.

If we are to receive the full benefit of such technology innovation to reduce the risks associated with the highest priority environmental problems, *the market dysfunction symbolized by this lagging rate of investment in technology innovation for environmental purposes will have to be addressed in a number of areas. These areas exist both within and outside of the environmental regulatory system and adversely affect all groups involved in solving environmental problems, causing tremendous uncertainty and inertia and a perception of excess economic risk.* The TIE Committee believes that these problems can be addressed effectively while fully protecting human health and the environment. The need to protect human health and the environment during testing and early commercial use of any innovative technology is considered paramount by the TIE Committee. Testing or use of an innovative technology may have to be limited, if it cannot be done safely.

It should be recognized that many current environmental policies are neither helpful nor benign with respect to technology innovation. Moreover, the philosophical neutrality towards technology innovation for environmental purposes in statutes, legislative histories, regulatory policy, regulations, and administrative systems is hampering national efforts to both solve environmental problems and increase economic productivity. The Federal Technology Transfer Act of 1986 (FTTA), which is as yet underutilized, and certain features of the 1990 amendments to the Clean Air Act represent the beginning of a change to a more helpful governmental role.

The Need for Government Action Now

The TIE Committee reiterates its January 1990 recommendations: it is critical that EPA evaluate the effectiveness of existing innovation programs, issue a technology innovation policy for the environment, and develop a technology innovation strategy.

The time is right to take these steps. A growing recognition exists, inside and outside of the EPA, that technology innovation for environmental purposes[1] is essential to the success of environmental programs in the United States.

Governments' roles are critical. Although less than 10 percent of all U.S. investment in technology innovation for environmental purposes is by federal and state governmental agencies, most innovations trigger regulatory oversight during research, development, and/or demonstration, and all require regulatory approvals for use for compliance purposes. The governmental role as gatekeeper and overseer transcends its role as investor in technology innovation for environmental purposes. Thus, while added government financial support would be helpful, improved regulatory and administrative processes are vital.

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[1] The term "technology innovation for environmental purposes" includes all types of technology innovation that have a beneficial effect on the environment, i.e., pollution prevention (such as manufacturing process changes), pollution control and remediation, information systems, and management practices. In particular, however, the TIE Committee notes that it is technology innovation involving pollution prevention and pollution control that is most affected by permitting and compliance systems, and therefore these types are especially targeted by this document. In the interest of brevity, at times other similar phrases, such as "innovative environmental technology," are used interchangeably.

The process of technology innovation is made up of many steps, each one of which is critical to the ultimate success or failure of a technology. Unless the environmental regulatory system provides a constant incentive to innovate, the likelihood is increased that worthwhile technologies will not complete the necessary steps to commercialization. It is particularly important that the EPA make technology innovation a high priority, because national policies are the model for the states and because it is at the national level that incentive and institutional systems to foster technology innovation can be most efficient.

The TIE Committee commends the increasing number of initiatives undertaken by EPA and states to foster technology innovation for environmental purposes. These include:

- EPA's establishment of the Pollution Prevention Office and the Technology Innovation Office (in the Office of Solid Waste and Emergency Response)
- The steps suggested in the RCRA Implementation Study to aid the development and use of innovative technologies for RCRA compliance purposes
- The steps outlined in the Office of Enforcement's Enforcement in the 1990s Project on strengthening the state/EPA relationship for innovative enforcement and remedies (including specifically acknowledging testing of new technologies as one of the potential benefits of innovative remedies)
- The increased support by the Office of Research and Development (ORD) for the testing and commercialization of innovative environmental technologies
- The several state integrated, or cross-media, inspection programs, and the several state toxic use reduction programs
- The recent report of the Science Advisory Board, "Reducing Risk: Setting Priorities and Strategies for Environmental Protection," which redefines how to set priorities for solving environmental problems.

These steps, however, represent only a start in the right direction. **It is now time to increase the national capacity to develop the technologies needed to solve the most important environmental problems.**

Focus on Permitting and Compliance Policy

Permitting and compliance systems, as they function today, discourage all stakeholder groups from taking the risks necessary to develop innovative technologies -- whether for pollution prevention or for pollution control -- and to bring them into routine use to solve environmental problems.

This document summarizes the TIE Committee's investigation of the impact of the two key regulatory administrative processes of the environmental system in the United States -- permitting and compliance -- on such technology innovation. It is based on the TIE Committee's extensive fact finding processes to gather information from the segments of society that have the most at stake. These "stakeholders" include regulated communities (users of technology), regulators (federal, state, and local), providers of environmental products and services (among whom are the technology developers), the providers' investors, and the organized environmental community.

The recommendations herein represent the consensus of the Focus Group that developed them and of the TIE Committee. The Focus Group had 14 expert members drawn from six state agencies, technology developers, regulated firms, the financial community, and the organized environmental community. To further broaden its information base, the Focus Group heard presentations from EPA's permitting and compliance programs (air, water, and solid/hazardous wastes), held two public Fact Finding meetings, and was supported by a small contractor effort. Twenty eight oral and five written presentations were received at the two Fact Finding meetings, most of which primarily addressed RCRA, and a large number of other meetings and discussions with stakeholders were held to extend the Focus Group's investigations.

The TIE Committee wishes to emphasize that the environmental statutes and regulations, and their enforcement, "make the market" for these very same technologies. However, uncertainties, costs, and delays associated with the permitting of tests and of early commercial uses of innovative environmental technologies, and the unpredictability and inconsistency of enforcement, are significant disincentives that discourage technology innovation for environmental purposes. These combine to create high-risk,

low-reward market conditions that need to be rectified if innovative environmental solutions are to be found and used.

Dysfunctions in the marketplace for environmental technology and their causes within permitting and compliance systems are the focus of this report. It characterizes the conceptual framework of permitting and compliance systems that would best encourage environmental innovation. It further recommends specific changes in policy and procedure for permitting and compliance programs that are needed to encourage technology innovation for environmental purposes.

The Recommendations

Primary Recommendation.

The TIE Committee's primary recommendation is that the Administrator of EPA, working within EPA, with state and local agencies, and with the Congress, make interrelated improvements in environmental permitting and compliance systems necessary to foster technology innovation for environmental purposes, within the overriding goal of protecting human health and the environment.

Five categories of recommendations and improvements are made in this report. These recommendations are seen by the Committee as being interrelated and synergistic. The recommendations are as follows:

Recommendation 1.

Modify permitting systems to aid the development, testing, and demonstration of innovative technologies for environmental purposes.

Testing and demonstration is central to the process of defining the useful range of performance of innovative technologies. A successful program of testing and demonstration, conducted during research and engineering on promising technologies, will produce performance curves ("performance envelopes") and cost of performance data that guide the future use of these technologies to solve environmental problems. The better the data, the greater the certainty that the appropriate applications of an innovative technology can be projected. With better test and demonstration data, innovative technologies can be introduced into commercial use for compliance purposes with greater assurance.

No viable permitting process operates under any of the media-specific environmental statutes for testing innovative technologies for environmental purposes. The flexibility to evaluate the capability of promising technologies under safe testing conditions is not adequately provided under current permit and associated administrative processes related to testing and demonstration. The Committee heard several examples where the time to test, cost of testing, and range of testing became exaggerated by permit procedures. One company told the Committee that it maintains a money-losing international operation primarily because of the lack of a reasonable, predictable testing process in the U.S.

Significantly, no specific provision exists in the Clean Air Act (CAA) or the Clean Water Act (CWA) for testing and demonstration permits. As currently interpreted, neither statute recognizes the unique nature of testing and demonstration, and tests and demonstrations under these statutes are conducted under *ad hoc* mechanisms. (Note that this report does not consider new features of the CAA resulting from the 1990 amendments, which were passed after the completion of the report.) The Resource Conservation and Recovery Act (RCRA) does have a statutory provision for testing permits ("research, development, and demonstration permits"), but the program implementing the testing provision is judged by the Committee to be ineffective. The Committee notes that the Agency's RCRA Implementation Study drew substantially the same conclusion.

The ability to test and demonstrate technologies varies widely from state to state, and data developed in one state is often not usable in another state, compounding the problem. The lack of a functioning and predictable regulatory and administrative process to test and demonstrate technology severely restricts the pipeline of innovation for environmental purposes in the United States.

The Committee recommends that permitting programs be modified to create specialized permit processes for the testing and demonstration of innovative environmental technologies. Permitting processes for tests and demonstrations of innovative technologies should be instituted, expanded, and streamlined, and designed to encourage technology innovation under each of the major "media" statutes. At a minimum, existing statutory provisions should be fully employed to increase opportunities for and flexibility in permitted tests. **The Committee recommends**

coordination of these specialized permitting programs across the environmental media. In addition, a new permitting process for tests and demonstrations might be created under a single authority. These processes should be designed to yield a predictable and timely process for regulatory oversight of testing, one that protects human health and the environment and simultaneously affords flexibility to testing programs.

Another problem is related to the lack of viable permitting processes for designated testing and demonstration centers: there are few locations in the United States where a series of tests of innovative technologies can be performed, except under the terms of facility operating permits. Specialized testing centers can offer greater flexibility, particularly during the more risky stages of technology development, while providing safeguards to assure that testing will not endanger public health and the environment. **The Committee recommends that a system of dedicated testing centers be established in the United States.**

These specific recommendations are discussed in greater detail in Section VI, beginning on page 52.

Recommendation 2.

Implement permitting processes that aid the commercial introduction of innovative technologies for environmental purposes.

The risk associated with early commercial uses for compliance purposes of an innovative technology is greater than risks associated with using known technologies in similar applications. Uncertainty about the capability of a newly-available innovative environmental technology is greatest when it is first proposed for use for compliance purposes.

At this time, permit writers and the public are unfamiliar with that technology and have a higher level of concern than for a well-proven technology. In some cases this concern may be well founded. In other cases, it may not be. The record shows that the lack of public confidence and trust stands as a major impediment to the development and use of innovative technologies. This leads to difficulty, delays, and extra expense associated with reviews of permit applications to use these technologies for compliance purposes, problems made all the worse by the need to satisfy, simultaneously and without coordination mechanisms, the requirements of various levels of government and in potentially more than one of the environmental media.

These uncertainties combine to create a perception of excess risk that deters investors and technology developers from developing innovative technologies and that inhibits their introduction into commercial use. The extra cost, time, and uncertainty associated with application drafting, negotiation of permit terms, and pre-permit data gathering for a proposed use of an innovative technology are so excessive as to discourage innovation. Consulting engineers and prospective users of the innovative technologies thus tend not to recommend or use these technologies. These points, and allied factors, were repeated both to the Focus Group on Environmental Permitting and to the Remediation Technologies Focus Group. This is a problem that could be alleviated with effective institutional systems enabling testing. Without better systems for testing, data gaps will continue to compound the difficulty of introducing innovative technologies into commercial use.

The Committee makes two major recommendations aimed at reducing risk, cost, time, and uncertainty and at involving the public effectively in the process of introducing innovative technologies for environmental purposes. **The Committee recommends that EPA, and other environmental agencies, afford high priority to these permit applications.** Although they are the most difficult to consider, they represent the future. The reviews of permit applications for newly introduced innovative technologies should be designated high priority and should be coordinated across the environmental media and across jurisdictions.

Secondly, **the Committee recommends that a special, two-phase permit process be introduced to streamline and make more predictable the consideration of early compliance uses of innovative environmental technologies and, to build public confidence, provide for early, substantive public involvement.** The permit process can be streamlined by adding a first step, a pre-permit application screening step involving the key stakeholders to discuss the concept of what will be proposed. At least three key groups would be involved in the screening step: the potential applicant, the permit writers, and the public.

These specific recommendations and additional detailed recommendations are discussed fully in Section VI, beginning on page 66.

Recommendation 3.

Use compliance programs to encourage the use of innovative technologies to solve environmental problems.

Strong, predictable, and consistent enforcement of existing regulations, rather than the mere existence of regulations, is critical to the realization of planned environmental progress. Enforcement can be a primary motivator of regulated organizations to comply, using conventional or innovative technological solutions. Predictable and consistent enforcement, by sharpening the timing and degree of the application of requirements, sharpens the definition of markets. It is therefore critical to innovation.

The Committee makes two major recommendations. First, **consistent with the recommendations of EPA's own recent enforcement review, the Committee recommends that EPA and the states create and reinforce the expectation of the need to comply.** Strong, predictable, targeted enforcement triggers a problem solving mentality and is therefore supportive of the development and use of both pollution control and pollution prevention technology. Such enforcement programs accomplish this because they assure that a market for such technologies will exist and will be of predictable size and character.

Second, **EPA and state agencies should increase flexibility in enforcement actions involving innovative technologies.** A compliance based on strong, predictable enforcement provides a basis for flexibility in the choice of remedies during enforcement actions, aiming at encouraging the use of innovative technologies under appropriate circumstances. Agencies can also make meaningful use of waiver provisions and "soft landing" strategies, can make creative use of compliance penalties, and can increase coordination in compliance programs across the environmental media and across jurisdictional lines. These and other steps to introduce flexibility into compliance situations are necessary when innovative technologies are involved because these technologies are inherently less certain than conventional technologies.

These specific recommendations are discussed in greater detail in Section VI, beginning on page 80.

Recommendation 4.

Support regulators and other involved communities to maximize the effectiveness of improvements recommended in permitting and compliance systems.

Although some positive incentives and support systems exist, no important stakeholder group is currently encouraged, in net effect, to foster innovative technologies for environmental purposes. Recommendations 1, 2, and 3 address the types of changes that are needed to improve the institutional systems involving the development, testing, demonstration, and introduction of innovative environmental technologies. Recommendation 4 addresses the kinds of informational and motivational support that are necessary if environmental professionals and the public are to embrace, or at least consider, innovative solutions. These kinds of support are critical. The Committee's fact finding processes revealed that even if individuals are philosophically and financially inclined to try innovative solutions, the information and the incentives available often fall short of what is needed to translate this inclination into success.

The Committee recommends that a system of incentives, training, and other support be instituted to increase the retention and flexibility of permit writers, inspectors, and other compliance staff. Specifically, the Committee recommends the establishment of a job ladder for these officials, backed up by policy, job standards, training, data sources, and incentives. The job ladder should be designed to encourage cross-media expertise and the cross-media consideration of permit applications and the cross-media review of compliance situations. The Committee bases these recommendations on the glaring lack of systematic support that now exists. For example, RCRA permit writers are not even credited with "beans" for acting on research, development, and demonstration (RD&D) permits (a problem that was specifically highlighted by the Agency's RCRA Implementation Study). Another example: the several states participating in the Focus Group indicated that their permit and compliance personnel find it extremely difficult to find information about innovative technologies, information that is critical to their ability to consideration of appropriateness, good faith effort, and other factors.

Similarly, **the Committee recommends that support be provided to prospective innovative technology permittees, including both technology developers and technology users.** Informational programs are needed to increase their awareness of government's interest in innovative solutions, the existence and function of innovation programs, and data about innovative technologies. The Committee found, for example, a widespread ignorance of the handful of new centers at which some kinds of innovative technologies can be tested.

The Committee recommends that EPA strive to make more systematic the role of its Office of Research and Development (ORD) as a technology consultant to permit writers and compliance staffs. ORD's clearinghouses and data bases were seen by the Committee as helpful, but not sufficient, tools for collecting and disseminating information about innovative technologies. **Further, the Committee recommends that a "technology advocate" function be established by EPA,** potentially in ORD, to (1) convey innovation policies, (2) serve as a point of contact on innovation processes under regulations and administrative systems, (3) track the progress of permit applications involving innovative technologies, and (4) provide data about the performance of innovative environmental technologies in tests, demonstrations, and early commercial uses.

Critically, the Committee recommends that EPA institute systems to provide the public with information and support related to the testing, demonstration, and use of innovative environmental technologies. The Committee developed the belief that one of the most significant barriers to the implementation of innovation environmental technology is lack of public trust in the information presented during the permit process, as well as in the actual process of permit review and approval. To address this problem, the Committee encourages an early, substantive role for the public in permit processes involving innovative technologies. The two-tiered permit process described above would be one important step in the right direction. Another is to create a paid technical and regulatory process support agent for communities involved in proposals for testing, demonstration, or use of innovative technologies. In this regard, the Committee supports expansion of the Technical Assistance Grant (TAG) program under Superfund to address all proposed applications of innovative technology. An independent foundation, co-funded by government, the private sector, and foundations, might best fulfill this function.

These specific recommendations are discussed in greater detail in Section VI, beginning on page 85.

Recommendation 5.

Identify and remove regulatory obstacles which create unnecessary inflexibility and uncertainty or otherwise inhibit technology innovation for environmental purposes.

The Committee has noted several regulatory "glitches" that appear to inhibit the development and introduction of innovative pollution control or pollution prevention technologies. The glitches identified by the Committee were not the result of an exhaustive search, but, rather, arose from its other investigations. Yet, the fact that glitches were identified under each major media statute without a specific effort to find them gives rise to the recommendation that EPA undertake a systematic effort to identify and remove regulatory obstacles.

For example, the Committee notes that the delisting process under RCRA serves as a deterrent to innovation. The delisting process is frequently undertaken to gain recognition that treatment renders hazardous wastes non-hazardous. But application for delisting, which is undertaken only when an innovative treatment process has been developed, tested, and demonstrated, takes a long time, costs a lot, and has an unpredictable outcome. The one- to two-year delay at the end of the technology development cycle hits technology developers hard at a critical moment. Accordingly, the Committee recommends that EPA consider taking steps to reduce the impediment to innovation associated with this administrative regulatory process.

These specific recommendations are discussed in greater detail in Section VI, beginning on page 96.

Beyond Permitting and Compliance Policy

Changes to the environmental regulatory system will be needed to create incentives encouraging the environmental technology innovation process.

It is important to be clear that the measures recommended in this document will not fully solve all of the fundamental problems leading to a market dysfunction and an unsatisfactory rate of technology innovation for

environmental purposes. To a significant degree, these problems derive from the way the central approach to regulation in the United States -- "best available technology"-based regulations -- is frequently used today. Reliance on "best available technology"-based regulations impedes the development and introduction of innovative technologies, in part by "locking in" specific discharge, emission, or treatment requirements and, in part, by lacking mechanisms to encourage and facilitate technologies. The way the regulatory system now operates, the incentive to innovate exists primarily with respect to cost of performance and there is little, if any, incentive or opportunity to innovate for the better performance the nation will need, if environmental and the economic objectives are to be harmonized. Policy makers should reconsider the current reliance on this approach, remove rigidity, and create opportunities to develop and use innovative technologies.

Regulatory processes should be revised to expand beyond existing encouragements for innovation (e.g., as in water quality-based and air quality-based regulations) to create an incentive structure that fosters technology innovation and, more broadly, encourages each stakeholder group to contribute to the search for solutions to environmental problems. A systematic analysis of the motivations -- economic and otherwise -- of each stakeholder group will be necessary to design a complementary set of effective improvements.

Organization of the "Report and Recommendations"

The "Report and Recommendations" includes five major sections:

- **Section I is this Executive Summary.**
- **Section II is the "Membership of the Technology Innovation and Economics Committee."**
- **Section III, the "Introduction," outlines the "Background" for the report and the "TIE Committee's Goals and Process."**
- **Section IV is titled "All the Stakeholders Speak: The Findings." This section contains the findings that underpin the TIE Committee's rationale for its recommendations to strengthen permitting and compliance systems, and to identify and remove regulatory glitches that impede technology innovation.**
- **Section V describes the Committee's "Rationale for System Changes" -- its analysis of the key issues surrounding the**

relationship between technology innovation for environmental purposes and permitting and compliance systems.

- Section VI, "Recommendations for Action and Commentary," includes an "Executive Summary of Recommendations" and the "Detailed Recommendations for Action and Commentary." This final section provides a listing of each of the recommendations and subrecommendations and analyzes each.

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Note: See Appendix A for list of presenters at Focus Group fact finding processes.

III. INTRODUCTION

A. BACKGROUND

The environmental regulatory system in the United States was developed to protect human health and the environment. This system has achieved significant progress toward these goals, but much greater progress will be needed to meet both current and future environmental objectives, while attaining sustainable economic growth.

The National Advisory Council for Environmental Policy and Technology (NACEPT) and its Technology Innovation and Economics (TIE) Committee have concluded that the current environmental regulatory system tends to emphasize pollution abatement, rather than pollution prevention, and offers limited encouragement to simultaneous environmental and industrial productivity improvements. The environmental regulatory system includes the development of regulations, administrative practices and policies supporting the regulations, permitting programs, compliance and enforcement programs, and federal, state, and local research programs supporting environmental objectives.

Technology innovation has been viewed as a secondary goal of the environmental regulatory system. A comprehensive network of authorities, policies, and programs designed to stimulate technology innovation for environmental purposes does not exist. This has triggered a market failure: the investment rate for environment-related technology innovation is so low that the national ability to make environmental improvements is limited by a lack of technology. In fact, the investment rate for environmental control technology lags that of the economy as a whole.

Moreover, TIE Committee Fact Finding activities have indicated that environmental investment decisions are typically made separately from production investment decisions, although there is a trend towards integrated decision making. This implies strongly that pollution prevention investment, as well as pollution control investment, lags. This two-edged market failure threatens the health of the United States economy and places the health of the environment and the economy in opposition.

In the January 1990 "Report and Recommendations of the Technology Innovation and Economics Committee" to the Administrator of EPA, NACEPT concluded that the development and use of innovative

technologies are necessary to more efficiently and simultaneously improve the environment and enhance productivity and economic competitiveness. Technology innovation is essential to continued progress in environmental protection in the United States. This is the case for both improved production processes that increase productivity and prevent pollution, such as manufacturing process changes and modifications, and more efficient emissions control and cleanup technologies.

In the January 1990 report, NACEPT determined that a critical need exists to examine how the environmental regulatory system impacts technology commercialization and how factors external to the regulatory system (e.g., tax policy, corporate culture and decision processes) compound the problem of lagging investment in technology innovation for environmental purposes. **NACEPT, based on the TIE Committee's work, recommended that EPA assume a leadership role in fostering technology innovation for environmental purposes and that the Administrator take three key steps to address this market dysfunction:**

- **Evaluate the degree to which the implementation of U.S. environmental programs is effective in stimulating technology innovation**
- **Issue a policy statement expanding the Agency's mission to encompass fostering technology innovation**
- **Develop and implement a strategy to carry out the fostering role.**

To help the Agency implement these recommendations, in October 1989 the TIE Committee established the Focus Group on Environmental Permitting to examine the relationship between government permitting and compliance processes and the introduction of new technologies for environmental purposes. The Committee had developed the view, based on its investigations, that federal, state, and local permitting and compliance systems act as important barriers to innovative technology for environmental purposes, to both pollution prevention and pollution control technologies. These elements were seen to create a climate that is not suitable for technological change and that contribute to the inadequacy of market responses. The Committee asked the Focus Group to confirm or correct this view, and to suggest modifications to permitting and compliance systems that will encourage technology innovation without compromising the principal goal of protection of public health and the environment.

This document reports the results of the Focus Group's review. Other TIE Committee activities will examine other suggested sources of market dysfunction, including regulatory approach, liability systems, and corporate practices. TIE Committee recommendations are aimed at helping EPA put in place a system of positive and negative signals that encourages environmental problem-solving in the context of sustainable development. This, in turn, will enhance the market for innovative technologies for environmental purposes and improve the ability of the environmental agencies to achieve their goals.

B. TIE COMMITTEE GOALS AND PROCESS

Strategic Goals

The TIE Committee has two strategic goals which apply to all environmental technologies. These are to:

1. **Increase the development and commercialization of innovative technologies**
2. **Ensure the diffusion (use) of existing and new technologies.**

The TIE Committee believes that these goals can and must be accomplished while maintaining the primary purpose of the system: protecting human health and the environment. **The TIE Committee recognizes a hierarchy of technological approaches to environmental improvement.** In order of desirability, these are: technologies that prevent pollution (including waste minimization and source reduction technologies), recycling technologies, environmental control technologies, and cleanup technologies. To pursue these goals, the TIE Committee is examining (1) the effectiveness of the environmental system in ensuring a suitable climate for technological change and (2) the adequacy of market responses.

TIE Committee Process

The TIE Committee has identified impediments to environmental technology innovation that exist within the environmental system, diminishing its effectiveness. These impediments are regulatory, administrative, and systemic (see Findings). The Committee is reviewing ways to alleviate these impediments and to create positive incentives. In considering the response of the marketplace to the need for innovation in environmental technology, the TIE Committee is:

- Identifying ways of achieving better market responses leading to the development and use of new pollution prevention and environmental control technologies.

- Identifying ways to remove the impediments and to assist developers of these technologies (inventors, investors, and users).
- Reviewing ways that the public sector, the private sector, and the non-profit sector can work, alone or together, to provide assistance.

The TIE Committee process is designed to identify the key factors that would contribute to a climate in business and government that favors environmental problem solving. To this end, the Committee process involves engaging and seeking the views of all parties "at interest." These "stakeholders" include regulated communities, regulators (federal, state, and local), providers of environmental products and services, the providers' investors, the public, and the organized environmental community.

Charge to the Focus Group on Environmental Permitting

The Focus Group on Environmental Permitting was asked to examine the relationship between government permitting and compliance systems (federal, state, and local) and the process of technology innovation for environmental purposes. This analysis is critical to understanding the climate for technological change and the adequacy of market responses. The Focus Group was also asked to examine the impact of regulatory "glitches" -- regulatory requirements that have an unplanned, adverse effect on technology innovation and diffusion -- on the development and introduction of new technologies for environmental purposes. The Focus Group was to identify steps that can alleviate impediments and create positive incentives within the permitting and compliance systems, helping remove the existing market dysfunction.

Issues considered by the Focus Group include the following (discussed in Section V):

- Who are the major interested parties and what is their motivation with respect to the decision to invest in developing or applying an innovative technology for pollution prevention or for environmental control or cleanup?
- What are the resource and timing impacts on technology innovation and diffusion of permitting reviews by federal, state, an local authorities?
- What is the importance to technology innovation and diffusion of flexibility in permitting requirements and of cross-media consideration of environmental impacts of innovative technology?
- What is the importance to technology innovation and diffusion of flexibility in compliance practices?
- What is the potential to create incentives for technology innovation related to pollution prevention in permitting and compliance systems?

- What are the concerns of the public about technology innovation for environmental purposes?

Membership and Process of the Focus Group on Environmental Permitting

The Focus Group was comprised of 14 individuals drawn from six state agencies, technology developers, regulated firms, the financial community, and the organized environmental community. Most major offices of EPA participated as expert contributors. The Focus Group met in January and March, 1990, and agreed upon its mission and the methods to be used in accomplishing it. To broaden its information base, the Focus Group heard presentations from EPA's permitting and compliance programs (air, water, and solid/hazardous wastes).

The Focus Group then held two public Fact Finding meetings: May 16, 1990, in San Francisco and August 8, 1990, in Washington, D.C. (These meetings were noticed in the Federal Register and advertised in at least 12 wide-circulation periodicals. In addition, TIE Committee staff made over 100 telephone calls to state and local officials, environmental groups, companies and industrial groups, and trade associations.) Presenters were asked to provide comments about any positive and negative aspects of permitting, compliance, or regulatory processes that are believed to affect technology innovation for environmental purposes. Illustration of the significance of these comments and suggestions was requested using specific, real case studies.

Twenty eight (28) oral and five (5) written presentations were received at the two Fact Finding meetings. Most provided one or more case studies. The presentations came from technology developers and other providers of environmental products and services, regulated communities, EPA regulatory offices and researchers, and the environmental community (listed in declining order of the number of presentations).

In addition, the National Environmental Technology Applications Corporation (NETAC) prepared a report that describes a framework for considering the relative importance of the impact of potential impediments on technology innovation. The framework describes the stages of the technology development and commercialization process and identifies the points of interaction between that process and environmental permitting and compliance systems.

The Focus Group met in August, 1990, to review information available to it, make findings, and draft preliminary recommendations. The Focus Group defined characteristics of permitting and compliance systems that would encourage the development and diffusion of innovative technologies. It used these as the framework for its recommendations. It also listed the important perspectives that must be kept in mind when considering the value of potential recommendations. The characteristics and perspectives are discussed in the "Rationale for System Changes." The Focus Group met twice more by teleconference, during which this report and its recommendations were discussed, revised, and approved for presentation to the full TIE Committee. The TIE Committee approved these recommendations at its meeting on October 23, 1990.

IV. ALL THE STAKEHOLDERS SPEAK: THE FINDINGS

The Technology Innovation and Economics (TIE) Committee has held two fact finding processes over the past two years. One has helped build to the other.

The First "Report and Recommendations" of the TIE Committee

The first "Report and Recommendations" examined EPA's innovation programs, identifying the status and effectiveness of each in fostering technology innovation for environmental purposes. Based on this examination, NACEPT issued its January 1990 "Report and Recommendations of the Technology Innovation and Economics Committee." This document contains "Findings" that gave an overview of the critical role of technology innovation to the nation's success in protecting human health and the environment in the context of sustainable development, and introduced the concept that serious impediments, different from those facing other technology fields, obstruct the market process for technology innovation for environmental purposes. The Findings emphasized:

1. The need for federal leadership for this technology innovation
2. The need for a comprehensive policy to remove the major impediments obstructing this technology innovation
3. The need to erect a system of incentives that address the perceptions of risk within each stakeholder group, encouraging each to play its appropriate role in technology innovation
4. The nature of several of the major impediments that create an atmosphere of risk-averseness among organizations involved in technology innovation
5. The need to build a cooperative relationship among the stakeholder groups
6. The need for outreach to build the consensus that will be needed to sustain a mutually supportive relationship.

Findings on Permitting and Compliance Policy

The TIE Committee's second fact finding process examined the relationship between environmental permitting and compliance systems and technology innovation. The Findings from this process and the Committee's deliberations form the basis for Section V: Rationale for System Changes and Section VI: Recommendations and Commentary:

Finding 1.

Technology innovation, pursued through an integrated approach, is necessary for the achievement of environmental protection goals and objectives.

Technology is the source of most pollution, but can be designed in a manner to eliminate pollution or to reduce, recycle, control, or treat emissions and residues. Existing environmentally-beneficial technologies can be used more broadly. Improved technologies, too, can be applied to solve potential environmental problems. Environmental and productivity considerations must be integrated into the design of new technologies to ensure efficient, environmentally-sound production of goods and services.

Finding 2.

The federal government should assume leadership and establish a system of incentives favoring technology innovation. The goal of government is to build a cooperative relationship among governments, businesses, and academia for technology innovation for environmental purposes and for assuring sustainable development. At the heart of this relationship is consistency in the marketplace.

Governments' roles are critical. Although less than 10 percent of all U.S. investment in technology innovation for environmental purposes is by federal and state governmental agencies, most innovations trigger regulatory oversight during research, development, and/or demonstration, and all require regulatory approvals for use for compliance purposes. The governmental role as gatekeeper and overseer transcends its role as investor in technology innovation for environmental purposes. Thus, while added government financial support would be helpful, improved regulatory and administrative processes are vital.

The federal government alone is capable of this role, because the federal government primarily determines the stringency, applicability, timing, and longevity of environmental requirements. These requirements -- and their enforcement -- thus trigger and define the environmental marketplace. The federal signals dominate in the minds of regulated communities and technology developers. The process of technology innovation is made up of many steps, each one of which is critical to the ultimate success or failure of a technology. Unless the environmental regulatory system provides a constant incentive to innovate, the likelihood is increased that worthwhile technologies will not complete the necessary steps to commercialization.

It is particularly important that the Environmental Protection Agency make technology innovation a high priority, because (a) of the central role of regulations in triggering and defining the market for environmental products and services and (b) it is at the national level that incentive and institutional systems to foster technology innovation can be addressed most efficiently. The Committee specifically endorses recommendations of the RCRA Implementation Study that EPA encourage adoption by the states of innovation relief mechanisms and support state adoption of technology development and demonstration projects.

Finding 3.

Federal, state, and local environmental permitting and compliance programs, the primary administrative systems for implementing environmental regulations, provide underlying impetus for the use of environmental technologies. Administrative complexity, high cost, duplication, and layering, however, create a severe dysfunction in environmental technology markets. These problems, generally present in all environmental programs in the United States, are especially damaging to technology innovation for environmental purposes.

Federal, state, and local government permitting and compliance policies are frequently duplicative and confusing. There is little coordination among relevant agencies. Traditionally, and consistent with the underlying regulations, permit and compliance programs are specific to a single environmental medium (e.g., air, water). Movement toward multi-media inspections and enforcement is occurring at both the state and federal level, however. For example, up to 25 percent of EPA's enforcement actions during FY 1991 will be multi-media in scope, according to the Office of Enforcement's 4-year strategic plan. It should also be noted that compliance with one permit may cause non-compliance with other media-specific permits at operating facilities. This is particularly damaging to both tests and early commercial uses of innovative technology.

As a result, the current system often precludes the most efficient use of environmental resources in any given operating facility and does not encourage technology innovation and the search for efficient solutions to environmental problems. It particularly discourages technology opportunities for pollution prevention and the selection of options whose performance exceeds what is minimally required to comply.

Finding 4.

Predictable and consistent enforcement of regulations, rather than the mere existence of regulations, creates markets for innovative technology.

Environmental regulation is now understood as a force to internalize external costs of production and other human activities. The environment is no longer a free good to be used as a dumping ground for wastes, and compliance expenditures for the most part involve the purchase and installation of environmental technologies. Critically, regulation-related enforcement policies give greater definition to the timing and dimensions of environmental technology markets. This clarity is important to increasing the predictability of the market, a key factor to technology developers and users and to their investors.

The lack of predictable and consistent enforcement at all levels of government dampens the expectation of the need to comply with environmental requirements and, therefore, diminishes or forestalls the need to purchase environmental products and services. Similarly, the lack of predictable enforcement discourages permittees from using innovative technologies, which inherently expose them to greater risk, and discourages entrepreneurs from investing money and effort in the technology innovation process.

Finding 5.

The cost, risk, and complexity of permitting systems associated with testing and demonstrating innovative technology for environmental purposes is excessive. There are few locations in the United States where tests and demonstrations of innovative technologies can be performed. No viable permitting process exists for those few that do.

There is no functional permitting system for testing and demonstrating innovative environmental technology. Under the Clean Air Act and the Clean Water Act, there is no permit for tests or demonstrations, and ad hoc processes for regulatory oversight of tests and demonstrations have only partially filled the gap. RCRA "RD&D" permits are used only infrequently. In each case, the protection of human health and the environment so dominates regulatory thinking that technology developers usually cannot define the range of applicability of an innovative technology. A balance can be found.

Permitting processes for tests and demonstrations of innovative technologies should be instituted, expanded, and streamlined and designed to encourage technology innovation under each of the major media statutes. In some cases, this may require legislation. Similarly, testing centers -- whether operated by private organizations, EPA, or other governmental agencies -- should be encouraged and supported. Specialized permitting processes should also be designed to ease and speed the startup and operation of these facilities. Some might be established at existing and unused federally-owned sites.

The need to protect human health and the environment during testing, demonstration, and early commercial use of any innovative technology is considered paramount by the TIE Committee. However, the TIE Committee believes that this can be accomplished while allowing wider testing and demonstrations of innovative technologies for environmental purposes. The Committee also believes that the potential benefits of innovative technologies for environmental purposes counterbalance limited, temporary deviations from standards that may occur during testing and demonstration, particularly when testing is conducted under environmentally safe conditions.

Finding 6.

The lack of institutional recognition of the high priority of technology innovation and the complexity of the permit application process inhibits many technological ideas from flourishing, causes excessive time delay, and imposes excessive costs on the development and early commercial uses of innovative technologies.

Permit application has become an art practiced largely by consulting firms and some staffs of major corporations, due to the complexity and conflicting nature of regulatory requirements. The cost and time for application drafting, negotiation of permit terms, and pre-permit data gathering are so excessive as to discourage the development, testing, and commercial use of innovative technologies for environmental purposes. Costs associated with preparing permit applications and filing for permits can actually exceed the cost of a technology, thus creating significant disincentives. The Committee heard several examples of this.

Operating facilities with existing permits are especially discouraged from applying for new permits based on the use of an innovative and environmentally-effective technology for a variety of reasons. These are discussed in the Recommendations and Commentary section of this report.

Finding 7.

The risk associated with testing and early commercial uses of an innovative technology is greater than risks associated with using known technologies in similar applications. The record shows that the lack of public confidence and trust stands as a major impediment to the development and use of innovative technologies for environmental purposes.

A key step in fostering technology innovation for environmental purposes must, of necessity, address public concerns. Moreover, unless permitting and compliance systems are effective, public confidence cannot be earned.

On the other hand, unless "performance envelopes" (i.e., the range of applicability of technologies) are defined, a "Catch-22" will exist that undermines public confidence in innovative technologies, adds to the perception of investment risk by technology developers and the financial community, and deters potential commercial users. Engineers' ability to determine performance envelopes during testing -- and therefore to be able to project the potential usefulness of that technology at distant sites -- is critical to reducing the risk to public health and environment associated with demonstration and subsequent use for compliance purposes.

The solution to this dilemma can be found in redefining the purpose of permit and compliance systems towards (a) assuring the enforceability of applicable objectives (standards), (b) assuring that a positive record exists of facility's compliance history, (c) developing accurate and effective self-monitoring systems (to assure compliance), and (d) undertaking enforcement against violators, while (e) establishing a substantive process for public involvement that can build confidence and (f) allowing sufficient flexibility for performance envelopes to be defined. Thus, both a strong process for public involvement and flexibility with respect to technology performance and timing of achieving compliance (or test objectives) should be built into environmental permitting and compliance processes.

Finding 8.

Permit and compliance personnel turnover is excessive, causing loss of institutional memory, the use of inexperienced personnel, and inconsistent permitting and enforcement approaches.

The high turnover rate is particularly damaging to the technology innovation process, because the expertise required for regulatory consideration of proposed uses of innovative technologies is greater than what is required for the consideration of conventional, "best available technology." One reason for this is the lack of training and other support for permit and compliance personnel. When this problem is combined with the lack of institutional policy support and guidance for the use of innovative technology and the fact that the process of considering innovative technologies is more time consuming, the importance of retaining permit and compliance personnel is even more apparent.

Finding 9.

Uncertainty about the timing, goals, and longevity of regulations increases investment risk and discourages the development and use of innovative technology for environmental purposes.

In the current regulatory system, (1) regulatory objectives and requirements remain in flux at least until promulgation and (2) old regulations can be modified and new regulations introduced under one or another environmental media program with little regard to creating some predictability and stability for regulated parties. This is very damaging to innovation, because the process of developing innovative technology generally takes ten or more years from the point of invention until commercial introduction.

The long lead time for technology innovation conflicts sharply with the uncertainty inherent to current regulatory practices. The inability to predict future environmental requirements and the inability to predict the longevity of current regulations generates an atmosphere of excessive risk and discourages investment in innovative technology for environmental purposes. In an unstable, uncertain regulatory environment, investment in innovation is usually delayed in favor of quick fixes with low capital costs.

Related to this problem, confusion exists about the intent of some regulations, especially with respect to definition of terms and interpretation of regulations and procedures. These problems must be identified and clarified, if compliance and innovation rates are to be increased.

Finding 10.

The current reliance on "best available technology"-based regulations misses a major opportunity to apply incentive-based approaches in rules and permits that can appeal to the motivations of interested parties.

Among the incentive-based approaches that could be applied successfully to improving environmental results and technology innovation are: (1) economic incentive tools (e.g., pollution fees and taxes, pollution trading, strengthening environmental technology patents and making them easier to obtain); (2) depreciation rules, tax credits, and other tax policies; (3) performance-based rules; (4) explicit, clear standards; (5) two-tiered regulations, which combine a "best available technology"-based first tier, an environmental goal-based second tier (that may be technologically or economically unattainable at the time of promulgation), and, potentially, pollution trading and credits, (6) subsidized and facilitated research, development, and demonstration; (7) improved technical assistance programs, and (8) improved technology transfer programs.

In the absence of the use of such incentive-based tools, the current command-and-control, "best available technology"-based approach to regulation offers at best mixed incentives for the development and use of improved environmental and production technologies. Such technologies, which often cost more than the technology on which a regulation is based, must await an uncertain recognition by rulemakers before their niche in the marketplace is assured. As previously noted by the TIE Committee in the January 1990 "Report and Recommendations," "before the imposition of an environmental rule, no incentive exists to apply an environmentally beneficial technology (other than good will or the desire to avoid an uncertain future liability).

After regulatory requirements are imposed, compliance with BAT-based rules requires the quick use of a technology with the requisite performance and provides no reward for the development and use of technology offering improved performance, regardless of the environmental and public health risk remaining after use of BAT." Only innovation with respect to cost of performance is encouraged. Opportunities must be put in place that create a system of positive incentives for stakeholders to seek innovative technological solutions to environmental problems -- and then put to use -- under each of the major media statutes. This is likely to require a mix of administrative and regulatory changes, plus legislation.

Finding 11.

Many affected and interested parties are uninformed about the purpose and benefits of, and regulatory and administrative systems that foster, technology innovation for the environment.

EPA and state regulatory staffs, regulated communities, technology developers and providers, and the public need various types of information about technology innovation. A governmental policy of fostering technology innovation will involve a significant management change in the operation of environmental programs. As mentioned in other findings, regulatory and other incentives will be needed. A communication strategy and consensus-building activities will be necessary. Training and education programs and technical assistance will be needed to increase the ability of interested parties to participate in a technology strategy that includes innovation for pollution prevention, as well as pollution control.

Finding 12.

The encouragement of pollution prevention has not been sufficiently built into permitting and compliance systems.

Significant opportunities exist to build into production processes an improved environmental result, avoiding the generation of pollution. Pollution prevention opportunities exist in virtually every industry, but current regulatory approaches have not been designed to foster the search for them or to foster their use. The media-specific approach to environmental regulation appears to be a major obstacle to pollution prevention. A lack of attention to pollution prevention is a major missed opportunity in environmental strategy: pollution is waste and waste reduces efficiency and productivity and, hence, profits. It is inherently in the interest of plant managers and corporate executives to reduce waste.

With this in mind, the TIE Committee has recognized that a hierarchy of technological approaches to environmental improvement exists, in order of desirability: technologies that prevent pollution, recycling technologies, environmental control technologies, and cleanup technologies. The TIE Committee believes that the use of a combination of these technological approaches can yield the most efficient reduction of environmental problems. The TIE Committee also believes that the policy of automatically triggering a major permit review when facility operators propose to introduce pollution prevention modifications to existing permits should be reconsidered, because this policy discourages pollution prevention and generally slows environmental improvement.

Finding 13.

Although some positive incentives exist, no important stakeholder group is currently encouraged, in net effect, to support innovative technologies for environmental purposes. This situation creates the major market dysfunction described above that needs to be addressed by environmental policy makers.

The disincentives affecting the involvement of each major stakeholder group in developing, demonstrating, and using innovative technologies, as they are seen by the TIE Committee, are summarized below:

- **Regulated Communities**: Fragmentation of responsibility for permitting and compliance across federal, state, and local jurisdictions; a lack of coordination of permitting processes and reviews and of compliance policies and practices across the media; a lack of permitting and compliance policies that aid the testing and commercial introduction of innovative technology (e.g., the lack of flexibility allowed for tests); regulatory uncertainty and risk associated with the use of innovative technology; and the lack of adequate information and technical assistance on permitting processes for innovative technology, on enforcement policies related to technology innovation, and on available innovative technology.
- **Regulators (Federal, State, and Local)**: The lack of encouragement and of administrative regulatory systems associated with permits for technology tests and demonstration and for test centers; professional risk in choosing an innovative technology over a "tried and true" technology in issuing permits for its early commercial applications (associated with the difficulty and lack of experience in determining the appropriateness of a proposed use of an innovative technology for compliance purposes at a particular site and with the possibility that a proposed use may be an attempt to avoid or delay compliance); for permit writers, extra time to consider the use of an innovative technology at a particular site without receiving encouragement (i.e., from policy) or credit (e.g., lowered requirements for number of permit applications processed, recognition for helping the innovation process); difficulty in coordinating with other levels of government and other

media-specific permit writers; lack of incentives for compliance personnel to be flexible with early applications of innovative technologies (that may have difficulty in "working the bugs out" on a timely basis, even in good faith efforts to do so); lack of resources in permitting and compliance programs at all levels of government (e.g., inadequate staff, lack of information about innovative technologies and their previous applications); lack of institutional credit for taking the time to consider a permit application for RD&D permits under RCRA.

- **Providers of Environmental Products and Services**: Lack of compliance processes that, by creating the expectation to comply, define markets and thereby reduce the risk of technology innovation and early commercialization; the need to satisfy, simultaneously and without coordination mechanisms, the requirements of various levels of government and in potentially more than one of the environmental media; costs and delays associated with obtaining permits for tests and demonstrations that may be significant in the context of the entire innovation project; the compounding of risk associated with the difficulty, expense, and delays of getting permits to test innovative technologies and permits for their early commercial application; uncertainty about the timing, goals, and longevity of regulations (and, therefore, about the timing, nature, and longevity of markets); and lack of encouragement for pollution prevention (and, therefore, about the markets for pollution prevention solutions to environmental problems).

- **Investors**: Lack of compliance processes that, by creating the expectation to comply, define markets and thereby reduce the risk of technology innovation and early commercialization; costs of testing that are magnified by the costs and time delays associated with obtaining permits to test innovative technology; the compounding of risk associated with the difficulty, expense, and delays of getting permits to test innovative technologies and permits for their early commercial application; uncertainty about the timing, goals, and longevity of regulations (and, therefore, about the timing, nature, and longevity of markets); lack of encouragement for pollution prevention (and, therefore, about the markets for pollution prevention solutions to environmental problems).

- **The Public**: The combination of hope, fear, and lack of understanding about technology in general and innovative technologies, in particular; concern with being the "guinea pig" that assumes all of the health risk associated with the failure of a test or commercial use of an innovative technology without being able to reap more than a small share of the benefit (reflected in the "not in my back yard" [NIMBY] syndrome); the inability of regulators, technology developers, and users of innovative technologies to assure the public that no harm to their health and safety and that of the environment will arise from tests or early commercial uses of these technologies (related to the problem that the public does not know who to trust, if anyone); the fact that no study can prove the absence of an effect; the lack of confidence that they are being fully informed about the purpose, benefits, and potential local impacts of technology innovation.

These Findings, and the following recommendations that derive from them, describe the TIE Committee's conclusions about the problems inherent to existing environmental permitting and compliance systems as they relate to technology innovation for environmental purposes and the reforms that must be made to take advantage of opportunities that innovative technologies offer for environmental gain. ***The TIE Committee believes that it is essential to make the reforms recommended in this report to deliver a clear and appropriate message to governmental and non-governmental stakeholders that a strong market response is desired and possible for solving environmental problems.*** Making these reforms will set in motion the integration of environment into both the public policy development process and the private investment cycle, leveraging the government's resources by encouraging maximum public and private efforts to innovate for environmental ends and, thereby, encouraging technology innovation for environmental purposes.

Looking Towards the Future

It is important to note that not all of these recommendations are new and unique, even to the TIE Committee (see the Committee's January 1990 recommendations, which overlap with and complement these recommendations). ***The TIE Committee reiterates its principal January 1990 recommendations: it remains critical to evaluate the effectiveness of existing innovation programs, issue a technology innovation policy for the environment, and develop a technology innovation strategy.***

The time is right to take these steps: a growing recognition exists that technology innovation for environmental purposes is critical to the success of environmental programs in the United States and an increasing number of commendable initiatives have been undertaken by EPA and states to foster technology innovation for environmental purposes. And, the recent report of the Science Advisory Board, "Reducing Risk: Setting Priorities and Strategies for Environmental Protection," defines how to set priorities for solving environmental problems. *It is now time to increase the national capacity to develop the technologies needed to solve the most important environmental problems.*

There are beginning to be steps in the right direction. More EPA and state activities than can be catalogued in this document are underway. These include:

- EPA's recent RCRA Implementation Study identifies the need for some reforms in RCRA permitting systems to aid the development and use of innovative technologies for RCRA compliance purposes.

- The creation by EPA of the Pollution Prevention Office (and the dedication of EPA resources to support pollution prevention initiative projects that can impact positively on the prospects for fostering technology innovation for environmental purposes) establishes an institutional point of focus for pollution prevention and initial projects across the Agency.

- The creation by EPA of the Technology Innovation Office (in the Office of Solid Waste and Emergency Response) is the first institutional recognition in an EPA regulatory office of the need to provide support to innovative technologies and to identify barriers to the use of innovative technologies.

- Another step is the increased vigor of the technology transfer programs of the Office of Research and Development (ORD) and the explicit support by ORD for the testing and commercialization of innovative environmental technology at such facilities as Center Hill in Cincinnati; the EPA Incineration Research Facility in Pine Bluff, Arkansas; the proposed testing center at National Environmental Technology Applications Corporation (NETAC); and the proposed Equipment Testing and Evaluation Center (ETEC) in Edison, N.J.

- The development of an "Interpretive Rule" by the Office of Air Quality Planning and Standards (OAQPS) aims to creating a routine process for considering tests of air pollution technology.

- Several states have instituted integrated or cross-media permitting programs that encourage pollution prevention and co-optimization in environmental control.

- The federal Toxic Release Inventory, state toxic use reduction programs, and support for technology development and commercialization are also hopeful developments.

- The Office of Enforcement's (OE) "*Enforcement for the 1990s Project*" includes a two-year pollution prevention project to test the incentives, disincentives, and tradeoffs involved in utilizing pollution prevention conditions in settlements.

All of these initiatives (and others not specifically noted here) by EPA and states deserve recognition and commendation -- and far more need to be undertaken in a coordinated, integrated fashion.

As the TIE Committee notes in Finding 10, however, fundamental changes will be needed to create a comprehensive and continuous system of incentives that systematically encourage the environmental technology innovation process. These necessary changes will extend beyond permitting and compliance to reach to the very basis of regulations. The changes must clearly reduce the risks and increase the rewards associated with the process of bringing technology into commercial use for environmental purposes, if the agency's risk reduction-based strategy is to be successful.

Specifically, policy makers should reconsider the way "best available technology"-based regulations are now developed and applied. Such regulations use agency established technology-based limits and use a technology to demonstrate that these limits are achievable. Even though these are performance-based requirements, they have a strong tendency to lock in the technology that is used to demonstrate achievability. To some extent, reliance on "best available technology"-based regulations impedes the development and introduction of innovative technologies. Among the impediments are the "locking in" effect and the lack of institutional mechanisms to encourage and facilitate technologies. Policy makers need to be careful to provide flexibility so that other technologies that can be used to meet the limits or to transcend them are developed and used. The way the regulatory system now operates, the incentive to innovate exists primarily with respect to cost of performance and there is little, if any, incentive or opportunity to innovate for the better performance the nation will need if environmental and economic objectives are to be harmonized. Policy makers should therefore reconsider the reliance on current approaches, should remove rigidity, and should create opportunities to develop and use innovative technologies. In this regard, the Committee notes that environmental regulatory requirements are frequently limited by a technology base that is insufficient to solve environmental problems to the degree recommended by risk analyses. In other words, ***the United States' environmental program is technology limited.***

While "best available technology"-based regulations are not inherently "bad," the way they are frequently implemented creates rigidity and has an adverse affect on technology innovation for environmental purposes. Consideration should be given to substituting regulatory processes that create economic incentives for technology innovation. Such regulatory processes might include performance-based standards (particularly those that establish requirements that meet desired environmental targets, rather than targets based on those that are currently achievable technically and economically), pollution fees and taxes, emission and effluent trading, depreciation rules, tax policies, and other such techniques.

The approaches currently in use to provide support to research and development should also be revisited, with consideration being given to techniques that provide additional financial and other assistance to technology innovation and which leverage governmental resources. For example, strengthening patents for environmental technology and making them easier to obtain will increase the incentive to innovate.

As with its January 1990 recommendations, the TIE Committee sincerely wishes to help EPA create a broad and clear strategic vision of what is needed to energize the innovation cycle for environmental purposes. The recommendations in this report suggest evolutionary modifications to the present environmental regulatory system that are designed to channel the creative and financial resources of the nation, to expand the technology base for solving environmental problems. This is the critical complement to EPA's risk reduction strategy for targeting critical environmental problems. The combination of these two strategies can increase the effectiveness of EPA in its role as the national environmental leader.

The following sections describe the Committee's findings and rationale in terms of the present dysfunction of markets for environmental technology, summarize the TIE Committee's five major recommendations to the Administrator, and provide detailed recommendations and commentaries about their significance in overcoming impediments to the environmental marketplace. Detailed implementation steps are included, where appropriate.

V. RATIONALE FOR RECOMMENDATIONS

Environmental regulations and associated compliance programs define and drive the marketplace for environment-related technology. Technology is the source of most pollution, and technology improvements are needed to meet both environmental and economic objectives. The role of regulation and enforcement is crucial, because most environmental costs are economic externalities. As a result, technologies will not frequently be used to improve the environment without clear definition of requirements and without effective compliance programs. Indeed, without regulatory acceptance, no technology can be developed and used to meet environmental requirements. Moreover, successful compliance programs engender the expectation on the part of affected parties that they are required to comply.

NACEPT, in the January 1990 "Report and Recommendations of the Technology Innovation and Economics Committee," has concluded that the development and use of innovative technologies is necessary to more efficiently and simultaneously improve the environment and enhance productivity and economic competitiveness. Technology innovation is thus essential to continued progress in environmental protection in the United States.

The TIE Committee's aim is to increase our understanding of the incentives and disincentives built into today's environmental regulatory system. Recommendations based on this understanding should help the Administrator make informed policy choices, thereby enhancing the ability of the organizations responsible for the management of environmental quality to influence the nature and pace of technology innovation for environmental purposes.

A. Analysis of Six Issues

The rationale for the TIE Committee's recommendations is rooted in the answers developed by the Focus Group on Environmental Permitting's investigations of the six issues listed in the section of this report entitled "TIE Committee Goals and Process". The TIE Committee's analysis of these six issues follows:

ISSUE 1.

The identification of the major interested parties -- the stakeholders -- and their motivation with respect to technology innovation.

Several categories of stakeholders are recognized by the TIE Committee: regulated organizations (whether in the private or public sectors); providers of environmental products and services; the financial community supporting the providers; regulatory agencies, federal, state, and local; and the general public. Their motivations with respect to technology innovation vary, and their willingness to pursue technology innovation is impacted differently by environmental permitting and compliance systems. The motivations include factors directly related to the features of permitting and compliance systems and factors that are, in large part, independent of these features. Critical themes include:

- **Compliance expectation**: whether regulated organizations expect to have to comply. (The effectiveness of compliance programs determines the dimensions and timing of markets.)
- **System predictability and flexibility**: whether the additional time required to obtain permits for testing and beginning early commercial use of innovative technologies can be predicted, and whether obtaining such permits can even be anticipated under reasonable circumstances. (Permitting programs affect technology developers, financiers of innovative technologies, potential users of those technologies, and the general public.)
- **Time and cost**: whether the time and cost impacts of gaining permits to test innovative technologies for environmental purposes are acceptable compared to those associated with other investment opportunities. (Permitting programs affect financiers of innovative technologies, technology developers, potential technology users, and the general public.)
- **Extraneous triggers**: whether application for a permit to test an innovative technology or to use it at a commercial facility triggers a new source review, a corrective action requirement, or another environmental review extraneous to determining the innovative technology's performance. (Permitting programs affect facility operators, technology developers, financiers of innovative technologies, and the general public.)
- **Testing the full range of performance**: whether allowable tests of innovative technologies can fully define performance envelopes. (Permitting programs affect technology developers, financiers of innovative technologies, and potential users of those technologies.)

Other factors are, in large part, independent of permitting and compliance systems:

- **Certainty of Regulations**: whether a stable and predictable set of regulations applies to the facilities and technologies potentially affected by an innovative technology (definition and stability of the market).
- **Range of requirements**: whether a large or a narrow range of requirements applies to facilities and technologies potentially affected by an innovative technology (definition and stability of the market).
- **Regulatory treatment of new, old facilities**: whether regulatory requirements affect new and old production facilities and equipment equally (turnover rates for production facilities and equipment and, therefore, the timing, nature, and size of markets).
- **Financial policies**: whether tax policy and accounting practices favor pollution control or pollution prevention solutions (financial characteristics of the market).

As discussed in the Findings, the TIE Committee concluded that the market signals created by current environmental statutes and regulations, permitting systems, and compliance programs do not, in net effect, convey to the major interested parties support for the search for technological solutions to environmental problems. *Importantly, permitting and compliance systems, as they function today, discourage individuals and firms in all categories of stakeholders from taking the risks necessary if innovative technologies are to be routinely brought into use to solve environmental problems.* As previously noted, the rate of investment in environmental technology research and development is relatively low, reflecting the net disincentives facing stakeholders, and the role of the United States as leader in environmental technology has diminished. *The TIE Committee believes that uncertainties, costs, and delays associated with permitting and compliance systems are significant factors in this market dysfunction.*

ISSUE 2.

Resource and timing impacts on technology innovation and diffusion of federal, state, and local permitting reviews.

The TIE Committee has found a complex picture, depending on:

- Whether a technology is being developed or is ready for commercial use
- The environmental medium being considered
- Whether a control technology or a pollution prevention technology is being considered

- The jurisdiction and the degree to which applicable requirements have been attained in a geographic area.

In general, the resource and timing impacts of the media-specific environmental programs appear to have a significant adverse effect on the cost and the time required to develop and demonstrate innovative technologies for environmental purposes and to bring them into commercial use. It appears that the environmental system under the Resource Conservation and Recovery Act (RCRA) poses the greatest resource and timing impacts to technology innovation for environmental purposes; that the Clean Air Act, as currently applied, poses somewhat fewer; and that the Clean Water Act, as currently applied, poses the fewest barriers. Both the Clean Air Act and the Clean Water Act are being interpreted in some jurisdictions and by EPA in ways that increase flexibility for testing and for applying innovative technology, despite the limited use of statutory provisions designed for that purpose. Moreover, there is typically no effective cross media coordination in permitting and compliance systems. This deters technology innovation in general, and constrains efficiency in environmental responses and to pollution prevention, in particular.

ISSUE 3.

The importance to technology innovation and diffusion of flexibility in permit requirements and of cross-media consideration of environmental impacts of innovative technology.

The TIE Committee has found that permitting requirements must simultaneously protect human health and the environment, and be sufficiently flexible to (1) allow performance envelopes (i.e., the range of acceptable performance of a technology) to be defined during testing and (2) encourage regulated facilities to co-optimize for environmental and productivity objectives when choosing from available technological options for achieving compliance. Several "characteristics of permitting systems that encourage technology innovation for environmental purposes," were identified by the Focus Group on Environmental Permitting. These place the need for flexibility in context with other necessary characteristics:

a. **Flexibility**: *The regulatory system should authorize the permit writer to incorporate a greater degree of flexibility into each permit for testing or use of an innovative technology than is generally the present practice, if means can be found to adequately protect human health and the environment.* This is critical during the testing of prototypes and demonstration units: the developer of innovative technology needs sufficient flexibility to define the performance envelope of a new technology (that is, to realistically determine the most appropriate operating conditions). For operating facilities, the terms of a permit should focus on the "result rather than the means to achieve it," encouraging the consideration of a broader range of technology options by the owner or operator (see below). A focus on result would provide flexibility to try innovative technologies, especially pollution prevention options.

b. **Compliance**: Technology developers and users need to be confident that compliance will be required during testing, demonstration, and early commercial use of innovative technologies. *Compliance efforts must therefore be consistent, predictable, and systematic. This is vital to allowing markets to develop for technologies, as well as require testers and users to operate responsibly, knowing that enforcement programs will assure compliance.*

   The need to protect human health and the environment during testing and early commercial use of any innovative technology is considered paramount by the TIE Committee. If means to provide this protection cannot be found, testing or use of an innovative technology will have to be limited. The TIE Committee believes, however, that approaches are available, even within existing statutory authorization, to allow sufficient flexibility during testing and demonstration to define performance envelopes -- while ensuring compliance. It should be noted that once the performance envelope of an innovative technology is defined by testing, early commercial use is less risky and, therefore, can become routine.

c. **Enforceability**: *Permit conditions must be enforceable.* Introducing flexibility into permit conditions in the interest of technology innovation cannot be allowed to diminish enforceability. Variances should be available for good faith efforts that are not completely successful, if there is no significant threat to human health and the environment.

d. **Predictability**: *The schedule for obtaining permits for testing and early commercial uses of innovative technologies for environmental purposes needs to be consistent and predictable, within and across jurisdictions.* The outcome of the process of obtaining an operating permit when an innovative technology is involved appears to be less certain, the time to obtain it longer, and the cost greater than would be the case if a conventional technology were involved. As noted in the Findings, this uncertainty is even greater if, as is usually the case, multiple jurisdictions or more than one environmental medium are involved, since coordinated permitting is not the norm.

   The need to assure the protection of human health and the environment during testing, while paramount, appears to have overwhelmed the need for flexibility sufficient to define performance envelopes. This is particularly so under RCRA and, to a lesser extent, under the Clean Air Act and the Clean Water Act. The outcome of permitting processes has therefore become difficult to predict for technology developers and time consuming and costly. In some jurisdictions, obtaining permits for testing is nearly impossible. When viewed across jurisdictional lines, the lack of predictability of permitting processes for testing innovative technologies is striking. The lack of a predictable, working process for permitting tests reinforces investors' perception of excess risk.

e. **Clarity**: *Clarity in permitting processes and in permit conditions are important to the testing and early commercial use of innovative technologies.* Clarity is important to the technology developers, technology users, regulators, and the public. Permit writers, especially, are assisted by clearly-stated principles.

f. **Confidentiality**: *To encourage early discussions with regulators and other interested parties, assurance must be provided that secret information about innovative technologies will be protected.* The expectation of confidentiality would encourage development and commercialization of innovative technology. It would also encourage more and earlier dialogue during technology development and a better flow of information between technology developers, technology users, and permit writers. Thus, a greater assurance of confidentiality would likely shorten the time for innovative technologies to be introduced and a more efficient use of resources by both permittee and permit writer.

ISSUE 4.

The importance to technology innovation and diffusion of flexibility in compliance practices.

Technology developers and users need to know that requirements will be enforced during testing, demonstration, and early commercial use of innovative technologies. A successful compliance system will create the belief on the part of affected parties that they are required to comply. The TIE Committee identified characteristics necessary to a successful compliance system that encourages technology development and use: consistency, predictability, and flexibility. Certain features of enforcement programs were also identified.

- **Consistency**: Consistency in compliance within and across jurisdictions is important to giving basic definition and size to environmental markets. *The TIE Committee concluded that, unless compliance programs are systematic and have a significant probability of identifying non-compliers, an expectation of the need to comply will not be created.*

- **Predictability**: Compliance schedules and the enforcement of permit conditions must be predictable. (Similarly, the introduction of new regulations must also be predictable.) *The TIE Committee has found that the market for innovative technologies and the degree of risk associated with investment in technology innovation are strongly subject to the predictability characteristic.*

- **Flexibility**: Innovative technologies have not previously been permitted for compliance purposes, so performance and schedules are not based upon a good data base derived from a permitted operating facility. They therefore need flexible targets. The need for compliance flexibility arises in two situations: (1) not all tests can be completed according to plans, within predetermined schedules, and fully successfully in terms of performance targets and (2) early commercial applications of innovative technologies may not achieve compliance on a timely basis or may never achieve full compliance. The TIE Committee believes that, under circumstances limited by the overriding need to protect human health and the environment, greater effort should be made to selectively use extended compliance schedules, and to define alternative environmental mitigation measures to provide soft landings for limited compliance shortfalls in cases where a good faith effort has been made to use innovative technologies. Innovative enforcement approaches are required to encourage and promote the innovations in environmental technology needed for long-term environmental improvement. Such an approach could encourage greater risk-taking with respect to technological innovation, and would be consistent with the innovative approaches recommended in *Enforcement in the 1990s*.

- **Features of enforcement programs**: Appropriate enforcement methods must contain provisions to *assure that no economic benefit obtains during periods of non-compliance associated with testing and early commercial use of innovative technologies for environmental purposes*. Enforcement programs must be seen as strong, yet be flexible and fair. *Regulated organizations misusing the flexibility feature must be strongly penalized*. The TIE Committee concluded that these features of enforcement programs would encourage reasonable technological and financial risk taking by technology developers, financiers, and regulated organizations.

ISSUE 5.

The potential to create incentives for pollution prevention in permitting and compliance systems.

The TIE Committee has concluded that considerable potential to enhance pollution prevention exists in both permitting and compliance systems. The potential is present in permitting and compliance systems to design an improved approach to regulation that increases certainty about the timing, applicability, and longevity of requirements; that includes incentive features in regulatory design; that emphasizes performance, rather than "best available technology"; and that decreases regulatory "glitches."

In permitting, the TIE Committee has identified several disincentives (see Findings), including the media-specific approach to facility permitting, the multi-jurisdictional oversight of single facilities (without coordination and, sometimes, common requirements), the easy triggering of permit reviews (e.g., by making "significant" facility modifications), the high cost and long delays associated with permits for research, development, and demonstration (RD&D) tests; and the lack of a regulatory climate that encourages and rewards experimentation. *The TIE Committee believes that the potential exists under current statutory authority to reverse most of these disincentives to pollution prevention.* Statutory modifications will be needed to address the rest of these disincentives.

ISSUE 6.

The perspective of the general public about technology innovation for environmental purposes.

There exists in the public both a fear and a hope about technology. The TIE Committee met with several senior individuals from the organized environmental community late last year (November 30, 1989) to discuss this point. Although the purpose of the meeting was limited to exploring individuals' perspectives, *a consensus emerged that technology innovation for environmental purposes, while not an end in itself, "is a necessary component to effectively protecting the environment now and in the future" and that "selective policies that foster useful technology innovation should be adopted."* Moreover, there is strong support in the environmental community and in the general public for pollution prevention, waste minimization, and recycling, all of which to a greater or lesser extent require technology innovation.

The public appears to be cautious, properly so in the opinion of the TIE Committee, that technology innovation for environmental purposes be approached in a manner that does not jeopardize human health and the environment. When the public feels that it is well informed and properly consulted, that undue risks are not taken that pose an imminent threat, and that assurance against unforeseen damage is provided (e.g., that corrective action to clean up a site where testing took place is guaranteed), the public's concerns can be vitiated.

B. Parameters Affecting the Design of Permit and Compliance Systems

In its investigation of these six issues, the TIE Committee considered six perspectives that reflect the wide variety of forces that impinge on the design and functioning of environmental permit and compliance systems. The six perspectives are:

a. **Jurisdiction**: Several levels of government necessarily are involved in decisions about the permitting of tests and early commercial use of innovative technologies: federal, state and local agencies. *The TIE Committee recognizes that differing viewpoints represented by agencies in the different levels of government must be addressed in recommending improvements in permitting and compliance systems, that increased coordination across jurisdictions is necessary, and that the roles of different levels of government need to be reconsidered and meshed together more effectively.*

b. **Media**: The three environmental media are regulated very differently. Several federal statutes provide differing approaches to regulation, permitting, and compliance. State and local laws further complicate the permitting and compliance systems with which developers or users of innovative technologies must comply. Each of these laws focuses narrowly on permitting and compliance systems targeted on a single environmental medium. *The TIE Committee is in strong agreement that a multi-media approach is needed in the interest of resource efficiency, to minimize cross-media shifts of pollution, and to provide incentives for accelerated technology innovation.*

c. **Pollution Prevention or Pollution Control**: Pollution problems can be addressed by preventing or minimizing pollution in the first place, by controlling pollution once it is generated, or by a combination of the two approaches. The TIE Committee's view is that a hierarchy of technology choices exists in which pollution prevention is preferred, all things being equal. The TIE Committee's investigation revealed that some features of permitting and compliance systems can affect technology choices differently, some encouraging pollution prevention and others encouraging pollution control. Similarly, permitting and compliance systems can encourage technology innovation to take one course or the other. *Because both pollution prevention and pollution control solutions are needed, the TIE Committee examined the ability of existing and potential features of permitting and compliance systems to encourage both types of technology innovation.*

d. **Existing or New Facilities**: *The public's lack of trust towards both regulated organizations and regulators is reflected in the regulatory treatment of new sources, which is often far more stringent than that for existing sources. Such "double standards" are evident in all three environmental media.* Information gathered by the TIE Committee shows strong agreement that it is extremely difficult to obtain permits for new locations and relatively easier to renew permits for existing facilities. At many locations, the difficulty of obtaining permits for a new facility is more important than whether a technology proposed for use there is innovative or the standard one.

The TIE Committee heard descriptions of situations in which companies' reluctance to become subject to permitting requirements under the Clean Air Act led them to apply innovative technologies. Their purpose was to keep emissions below regulatory thresholds and thereby to escape regulation. In other cases, however, attempts to apply innovative technologies to treat hazardous wastes on-site were abandoned by firms who did not wish to have regulatory oversight triggered under RCRA.

The performance requirements for environmental technologies and the degree of scrutiny given to technologies applied may differ. The triggering of a major modification provision under the Clean Air Act can have a vast impact on a facility's environmental requirements. Under RCRA, the choice of treating or even storing wastes on-site can bring a facility otherwise outside the purview of RCRA under its umbrella and can trigger a RCRA corrective action review. *The TIE Committee recognizes the variety of potential positive and negative impacts on technology choice created by the distinction between existing and new facilities, and considers these a major concern to the goal of encouraging technology innovation.*

e. **Geographic Considerations**: The location of two identical facilities in different geographic locations may place different strains on the environment or may subject the company to different state laws and regulations. This may, in turn, trigger different performance requirements and the need to use different environmental technologies. These geographic considerations may transcend state boundaries and are reflected in different requirements, such as attainment vs. nonattainment areas under the Clean Air Act, state to state variations in requirements under several programs, and water quality and effluent treatment requirements in different bodies of water. *The TIE Committee recognized and considered the need for geographic variation in environmental requirements and in technology choice.* The Committee also recognizes the importance of the state role in assuring that site-specific considerations are addressed, and the need for coordination to assure that information can be shared and properly applied to each unique situation.

f. **Stakeholders**: As discussed earlier, the TIE Committee recognizes five categories of stakeholders whose views and motivations must be considered if improvements in environmental permitting and compliance systems are to occur: regulated organizations, whether in the private or public sectors; providers of environmental products and services; the financial community supporting the providers; regulatory agencies, federal, state, and local; and the general public. *The TIE Committee has concluded that permitting and compliance systems, as they function today, discourage individuals and firms in all categories of stakeholders from taking the risks necessary if innovative technologies are to be routinely brought into use to solve environmental problems. The TIE Committee sought to identify and consider the motivating factors operating within each stakeholder group relative to the development and use of innovative technology for environmental purposes.*

Overall, the TIE Committee has concluded that current permitting and compliance systems do not create a positive incentive system. Therefore, specific changes (or types of changes) should be undertaken by responsible officials. These improvements are designed to address the specific market dysfunctions described above, to encourage the efficient use of resources for technology innovation for environmental purposes, and to increase the opportunity to use these innovative technologies to improve the nation's ability to protect human health and the environment.

VI. RECOMMENDATIONS FOR ACTION AND COMMENTARY

A. EXECUTIVE SUMMARY OF RECOMMENDATIONS

The Technology Innovation and Economics Committee of NACEPT recommends that the Administrator of EPA, working within EPA, with state and local agencies, and with the Congress, make interrelated improvements in environmental permitting and compliance systems necessary to foster technology innovation for environmental purposes within the overriding goal of protecting human health and the environment. These improvements fall into five categories:

1. Modify permitting systems to aid the development, testing, and demonstration of innovative technologies for environmental purposes.

2. Implement permitting processes that aid the commercial introduction of innovative technologies for environmental purposes.

3. Use compliance programs to encourage the use of innovative technologies to solve environmental problems.

4. Support regulators and other involved communities to maximize the effectiveness of improvements recommended in permitting and compliance systems.

5. Identify and remove regulatory obstacles which create unnecessary inflexibility and uncertainty or otherwise inhibit technology innovation for environmental purposes.

B. DETAILED RECOMMENDATIONS FOR ACTION AND COMMENTARY

Recommendation 1:

Modify permitting systems to aid the development, testing, and demonstration of innovative technologies for environmental purposes.

1.1 Institute a working system of specialized permits in all media for testing and demonstrating innovative technologies.

1.2 Develop a system of dedicated centers for tests and demonstrations of innovative environmental technologies.

1.3. Develop a system for cross-media and cross-jurisdictional coordination of the review of permit applications.

1.1 Institute a working system of specialized permits in all media for testing and demonstrating innovative technologies for environmental purposes, including

- ***a. Permits for specialized testing facilities***
- ***b. Permits for testing at other locations.***

Commentary

Testing innovative technologies for environmental purposes is necessary to define their performance curves, or envelopes (i.e., the useful range of acceptable performance of a technology), and to develop cost of performance data. The better the data, the greater the certainty that the appropriate applications of a technology can be projected. With better test and demonstration data, innovative technologies can be introduced into commercial use for compliance purposes with greater assurance. Testing may have to be conducted several times during research, development, and demonstration, as technologies are scaled up, re-engineered to improve performance and extend applicability, and finally demonstrated at commercial, operating locations.

a. THE INADEQUACY OF CURRENT PERMIT PROCESSES: The Clean Air Act (CAA)*, the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA) contain limited provisions aimed at fostering the testing of innovative technologies for environmental purposes. As noted in NACEPT's "Report and Recommendations of the Technology Innovation and Economics Committee" in January 1990, these provisions are few, and none has been widely used. RCRA, in Section 3005(g), provides authority for a permit process specifically for "research, development, and demonstration" (RD&D). This provision has been narrowly construed and is little used. The RD&D permit program has been delegated to fewer than 10 states, and only a handful of RD&D permits have been issued by EPA and the states. To encourage greater use of the RD&D permit program, the Agency's RCRA Implementation Study recommends that EPA consider centralized evaluation and even issuance of RD&D permits.

Under the CAA and CWA, no equivalent permit authority exists, and *ad hoc* mechanisms have evolved to create some flexibility for testing. Considerable testing is conducted of air and water pollution control technologies, although mainly at permitted operating facilities using the *ad hoc* regulatory methods. Under the CWA, for example, most permits are written under "Best Professional Judgement" -- "BPJ" -- allowing the permit writer flexibility to consider innovative solutions and local conditions. In sum, no viable permitting process operates under any of the media-specific environmental statutes for testing and demonstrating innovative technologies for environmental purposes.

At a minimum, existing statutory provisions should be fully employed to increase opportunities for and flexibility in permitted tests, and *ad hoc* mechanisms should be recognized and made systematic. EPA should consider options for a more comprehensive solution in the reauthorization processes for the environmental statutes, two of which -- the CWA and RCRA -- are about to begin. One option that deserves serious consideration is an omnibus testing and demonstration authority. Such an authority would bridge the media, providing a single permit process for environmentally safe, yet flexible, testing and demonstration of environmentally beneficial technologies.

The TIE Committee has further found that there is little cross-media coordination of permit application reviews. This compounds the difficulty of the permitting process for

* Note: It should be reiterated that the Clean Air Act has been amended, subsequent to the investigations and deliberations of the TIE Committee.

technology developers. It particularly discourages tests of pollution prevention technologies, if those tests would cross regulatory thresholds. The value of pollution prevention technologies may be most evident when viewed in a cross-media context.

Additionally, the ability to test and demonstrate technologies varies widely from state to state, and data developed in one state is often not usable in another state, compounding the problem. The lack of a functioning and predictable regulatory and administrative process to test and demonstrate technology severely restricts the pipeline of innovation for environmental purposes in the United States.

b. RECOMMENDED IMPROVEMENTS IN PERMITS FOR TESTS AND DEMONSTRATIONS: *The Committee recommends that permitting programs be modified to create specialized permit processes for the testing and demonstration of innovative environmental technologies*. Permitting processes for tests and demonstrations of innovative technologies should be instituted, expanded, and streamlined, and designed to encourage technology innovation under each of the major "media" statutes. At a minimum, existing statutory provisions should be fully employed to increase opportunities for and flexibility in permitted tests. *The Committee recommends coordination of these specialized permitting programs across the environmental media*. In addition, a new permitting process for tests and demonstrations might be created under a single authority. These processes should be designed to yield a predictable and timely process for regulatory oversight of testing, one that protects human health and the environment and simultaneously affords flexibility to testing programs.

c. PERMITS FOR TESTING CENTERS: Testing and demonstration of innovative technologies can take place at permitted locations specifically designed and designated for that purpose (see recommendation 1.2) or at other locations, particularly at permitted operating facilities. *Specialized permitting processes are needed for both.* Testing center permits should be cross-media based and issued for a substantial time period. Permit terms should be flexible enough to allow for the testing of a wide variety of technologies at a variety of sizes ranging from bench scale potentially through full scale. *The Committee endorses seven detailed recommendations for testing facility permits, as developed by EPA's Office of Cooperative Environmental Management (OCEM)*:

1. Scope of permit defined to ensure facilities' environmental safety. Permit application reviews for testing facilities would focus on the capability of a facility to safely test a proposed range of technologies, rather than the capability of every technology tested to achieve acceptable environmental performance during testing. Thus, the range of technologies tested would be limited to those that could be

safely tested within the facility. Scientists will then be freer to conduct tests that define the performance limits of technologies tested, while the facility's own structure and environmental control technology insulates the surrounding environment and nearby communities from harm.

2. Federal program, with delegation authority. Federal regulations would establish and guide the issuance of testing facility permits, but delegate program authority to states accepting the program. EPA would issue permits only in states that have not adopted the program, and then only with state concurrence. State authority to require more stringent standards would therefore be preserved.

3. Ten-year permit duration allowed. Permits would be issued for up to a ten-year period, with the possibility of renewal. A description of technology categories and testing parameters, including sufficient information to assure that the capability of the facility to safely conduct tests would not be exceeded, would have to be provided as a part of the application, but controlled flexibility would remain (see #4 below). Specialized requirements -- such as those under RCRA for a public review process, emergency plans, inspections, and corrective action -- would apply.

4. Installation of environmental controls required. Permitted facilities would have to have air emissions control equipment, water treatment or pretreatment equipment, solid and hazardous waste residuals pretreatment and storage capability, and environmental monitoring equipment sufficient to assure that public health and the environment are protected from pollutant releases during and after tests. This installed environmental equipment will, in essence, create a bubble of environmental protection around equipment being tested, ensuring no violation of applicable environmental regulations during and after testing. *Without test-specific review by responsible regulatory agencies, no test could be conducted if the capabilities and capacities of installed environmental controls could be exceeded during testing.*

5. Cleanup requirements apply. Application of the closure and post-closure requirements under RCRA would apply, assuring that no significant residual risk would remain at the testing location after the useful life of the testing facility is completed or the facility is otherwise closed down. Similarly, RCRA corrective action requirements would apply.

6. Public review process. Appropriate public participation processes (see subrecommendation 4.5) for permitting under federal and state statutes would be applied to proposed testing facility permits. Independent scientific expertise should be made available to the community, enabling them to evaluate the test facility to review safety, the range of tests proposed, time limits, etc. (see subrecommendation 4.5). Tests conducted within the constraints of the terms of a permit, once it is issued, would not be subject to individual public review, however.

7. Anti-loophole provisions. Time limits would be placed on the length of testing allowable for any one piece of equipment. This and other requirements (e.g., inspections, limits on quantity and time of storage of materials for testing) will assure that the testing facilities cannot be misused to circumvent normal requirements on treatment, storage, or disposal facilities.

d. NEEDED FEATURES OF PERMIT PROGRAMS FOR TESTS AND DEMONSTRATIONS: If EPA and other authorities are to facilitate such tests and demonstrations, whether at testing facilities or at other locations, improvements will have to be built into permitting systems and strong, positive signals will have to be issued from regulatory agencies. *It is important to note that the TIE Committee recommends that a systematic program be instituted to encourage, support, and train permit writers involved in permitting activities associated with tests and demonstrations (see subrecommendation 4.1 for details).* Another signal could be in the form of guidance that encourages and enables EPA laboratories to make the fullest use of the Federal Technology Transfer Act (FTTA) to take advantage of existing expertise and facilities inside and outside of the government in conducting joint testing projects.

The TIE Committee recommends that several specific issues be addressed and features be built into improved permitting programs to institute the set of needed improvements. They include:

1. **Flexibility**: *At a minimum, testing programs must have the flexibility to define performance envelopes (the range of applicability of an innovative technology for environmental purposes). Permitting systems are needed under each of the media statutes to allow such testing, as is coordination of media-specific permitting efforts across jurisdictions*:

- **RCRA**: Based on the results of its Fact Finding efforts, *the TIE Committee has concluded that, at present, the greatest need for change exists under RCRA.* There is effectively no RCRA permit available for locations where a variety of innovative technologies can be tested over time (i.e., permits for testing centers) and no effective permitting program exists for tests of single technologies (i.e., RD&D permits under Section 3005(g) of RCRA, only fifteen of which have been issued since July 1985). Fewer than 10 states are authorized for the RD&D permit program.

  Improvements can be accomplished by one of at least three methods, which may require administrative policy changes, statutory changes, or both. NACEPT has previously recommended three complementary solutions, each of which can be accomplished under existing authorities (January 1990, TIE Committee Recommendations 1.4.d [RD&D permit program modifications], 1.4.e [implementation of Subpart Y regulations for testing facilities], and 1.4.f [expanded use of Subpart X]). The TIE Committee compliments OSW for its support to extending the statutory time limit for RD&D permits from one (1) to ten (10) years. The Committee emphasizes that administrative revisions in the RD&D permit program are also critical to allow sufficient flexibility during testing. EPA's Office of Research and Development (ORD) has suggested that an administrative rulemaking, called the "Subpart Y" rule, could provide an alternate regulatory framework for testing facilities under current authorities, but no action on this concept has been taken after eight years. *The TIE Committee urges immediate action to address this crying need.*

Additionally, the TIE Committee recommends that the treatability rule be revised to allow, at the discretion of the permit writer, a larger volumetric treatability exception for hazardous waste testing. The amount would be greater than 1000 kg, but less than 10,000 kg, and linked to the technology, as well as to the site. *Further, the RCRA prohibition barring technology developers from collecting revenues for wastes treated during authorized tests should be eliminated in favor of reporting requirements and strict compliance programs that assure that the terms of testing, including the length of tests, are followed.* Such an approach should not create a loophole, and is very important to technology developers who must otherwise bear the full cost of tests. See also recommendation 5 for a discussion of several RCRA-related regulatory glitches.

- **CAA:** No testing permit provision exists under the CAA, prior to the 1990 amendments, but tests at small scale can be conducted without permits in most jurisdictions. An *ad hoc* administrative procedure involving ORD and OAQPS, called the "no action assurance" letter, has been devised to allow larger tests at operating facilities. This method does not provide sufficient predictability, certainty, and orderliness to the process of testing innovative technology. The procedure may be formalized by the so-called "interpretive rule," which has recently been developed by OAQPS to formalize current policy. *The TIE Committee commends OAQPS and ORD for this proposal and endorses the concept, while noting that it has not reviewed the terms in enough detail to comment on their sufficiency as a systematic system for testing.*

- **CWA:** No testing permit provision exists under the CWA, but considerable testing is conducted at permitted operating facilities. The current *ad hoc* system involves testing at sites permitted using the "Best Professional Judgement" permitting program feature -- "BPJ." The BPJ approach results in the granting of significant flexibility on a case-by-case basis by permit writers, but does not provide sufficient predictability, certainty, and orderliness to the process of testing innovative technology. Moreover, it places the additional burden on independent technology developers of conducting all testing at operating sites they do not control and for which they might be responsible in case a non-compliance situation arises during testing. Critically, BPJ cannot be used if effluent guidelines exist, as they do for more than 30 of the major water polluting industries. The complementary "Innovative and Alternative Technology" waiver provision (CWA Section 301(k)) is, unfortunately, little used. *The TIE Committee recommends that an established system of testing permits be developed under the CWA. EPA should seek to address this need in the CWA reauthorization process.*

2. **Compliance and Enforceability:** *At a minimum, regulations establishing specialized permits for testing innovative technologies for environmental purposes must assure that public health and the environment are protected at the same time that flexibility is provided*. The concern of the public that health and environmental quality might be jeopardized during tests and demonstrations is a primary limiting factor to technology innovation (see subrecommendation 4.5). This is true both for technology tests and demonstrations which are, by their nature, being conducted expressly to prove efficacy and

safety of individual technologies, among other factors, and for testing centers which, by their nature, are sites where a series of tests of unrelated technologies will be conducted.

The TIE Committee recommends that testing facility permits include provisions that minimize risk to the public and the environment and include provisions that assure their enforceability. As noted earlier, the lack of public confidence that regulated parties will behave responsibly with respect to the environment deters the issuance of environmental permits at new locations, as well as those for the testing of new technologies. *It must be clear to the public that permits for testing will not become loopholes to escape the requirements and intent of the regulations technologies must meet.* In its Fact Finding activities, the Committee was impressed that current testing programs have apparently not been abused by technology developers or regulated parties. New provisions that offer greater flexibility must retain such provisions as (1) limited time for tests, (2) corrective action requirements, (3) disclosure, (4) public participation, and others that assure necessary protection.

3. **Clarity**: *The TIE Committee recommends that the regulatory process for specialized permits for tests and demonstrations of innovative technologies must be clear in its intent and process. Likewise, permitting conditions must be clear.* Clarity, as noted previously, is important to technology developers, technology users, regulators, and the public. Permit writers and applicants, especially, are assisted by clearly stated principles and by institutional support in terms of policy, guidance, and rewards for carrying out these specialized permitting programs (see recommendation 4).

4. **Confidentiality**: *The TIE Committee recommends that additional steps be taken to assure the confidentiality of secret information about innovative technologies, both those tested at permitted facilities and those tested at other sites.* The expectation of confidentiality would encourage development and commercialization of innovative technology. And, as previously noted, it would also encourage more and earlier dialogue during technology development and a better flow of information between technology developers, permit writers, and technology users. Secure areas in regional offices and state agencies should be provided for confidential discussions and storage, and penalties should be imposed for violations of security.

1.2 Develop a system of dedicated centers for tests and demonstrations of innovative environmental technologies.

Commentary

The TIE Committee found that few designated locations exist in the United States where tests and demonstrations of innovative environmental technologies can be performed. Furthermore, the Committee found that there is no viable permitting process for dedicated testing centers under any environmental statute. The Committee has recommended that such a permitting process be instituted (see subrecommendation 1.1) and recommends that a national system of dedicated centers for tests and demonstrations be established. Specialized testing centers can offer greater flexibility, particularly during the more risky stages of technology development, while providing safeguards to assure that testing will not endanger public health and the environment.

a. THE CONCEPT OF TESTING CENTERS: Within the general theme that testing centers are facilities at which performance trials of innovative technologies are conducted, several variations have been built or proposed. Variations can revolve around institutional relationship and form, type of services offered, type of technology tested, availability to unrelated parties, and stage of technology tested. In what is perhaps their purest form, testing centers might be open door facilities, available as a fee-based service for anyone seeking a safe place for tests and demonstrations. These might be federally-operated, with services available under terms of the Federal Technology Transfer Act (FTTA), or not federally-operated.

Sometimes, testing centers are located in conjunction with in-house technology research centers, such as corporate research facilities investigating improved manufacturing processes and government agency research facilities, such as EPA's. In other cases, controlled condition testing could be one of the array of services offered by incubation centers, such as is now offered by the Illinois Institute of Technology Research Institute (IITRI) and as is proposed by the National Environmental Technology Applications Center (NETAC) in Pittsburgh. (NETAC offers other commercialization services, as well.) Another institutional home for testing and evaluation might be provided by a university affiliation, as is proposed at the New Jersey Institute of Technology for Edison, N.J.

Testing centers will also vary in terms of the type of technology tested: some facilities might be equipped to safely test all types of environmental control technologies, but most appear likely to be targeted on a single environmental medium and even on a subset of the technological targets within it. For example, EPA's Center Hill research facility in Cincinnati focuses on stabilization technologies and EPA's Pine Bluff, Arkansas, research facility focuses on incineration technologies.

Some facilities are "open to all comers," while others will be captive to a single organization or otherwise of limited access. Examples of each exist at this time. Testing is required at all stages of technology development and demonstration. Testing centers can provide services at each stage. Much testing, particularly of early stage technologies, can be conducted under existing operating facility permits, as long as existing permit conditions are not exceeded. Tests and demonstrations at larger scale present greater permitting difficulties, and testing centers may be particularly useful to satisfy this need.

b. THE NEED FOR TESTING CENTERS: RCRA RD&D permits are primarily applicable to the testing of single technologies. They allow only small quantities of waste material to be tested, are too restrictive of the range of conditions that can be tested, and are of limited duration (i.e., RD&D permits are issued for a one-year period, renewable for up to three times before reapplication is necessary). There are no formal provisions for research, development, or testing permits within either the air or water programs -- all testing must be done under a facility's full operating permit or under *ad hoc* mechanisms (e.g., "no action assurance" letters in the air program). The Committee heard several industry comments during its Fact Finding Meetings (comments confirmed by state regulators) that operating facilities, once they have obtained a RCRA, air, or water permit, are very reluctant to conduct research and testing of new technologies, if a significant change in emissions could result, thereby triggering a permit review. (See subrecommendation 1.1 for further comments.)

c. A NATIONAL SYSTEM OF TESTING CENTERS: *The TIE Committee therefore recommends that a national system of permitted testing centers be created and/or promoted. The principal characteristic of these facilities would be to allow innovators and developers, under controlled test conditions that protect human health and the environment during and after testing, to determine performance envelopes so that they and regulators can project potential efficacy at commercial facilities.* There are two principal benefits to the environment: (a) testing will be environmentally safe (because testing is conducted under controlled conditions and under the direction of professionals) and (b) information critical to reducing risks to public health and the environment associated with further testing and commercial use will be developed, and information that is important for writing operating permits and determining compliance conditions will be produced. There is also a critical benefit for technology developers: sufficient flexibility to test and demonstrate to the point that performance and cost curves can be defined, under safe conditions.

To support a national system of testing centers, several issues need to be addressed to assure that all involved parties can successfully fulfill their roles:

1. **Permit writers:** *It is important to note that the TIE Committee recommends that a systematic program be instituted to encourage, support, and train permit writers involved in permitting activities associated with testing centers (see subrecommendation 4.1 for details).*

2. **The public:** As noted in Finding 6, "(t)he record shows that the lack of public confidence and trust stands as a major impediment to the development and use of innovative technologies for environmental purposes." Public concern is particularly evident when permits for new facilities and new technologies are sought. *It is therefore extremely important that mechanisms for early and substantive public involvement, such as those discussed in subrecommendation 4.5, be included in the testing facility program*.

3. **Testing centers:** Such testing centers must go the extra mile to assure both the regulators and the public that testing will be done in a safe, environmentally protective manner. Testing centers should also:

    - Be secure
    - Be able to isolate tests and demonstrations from the outside environment
    - Have all the necessary media monitoring and environmental controls to assure that public health and the environment are protected during and after testing
    - Be staffed by trained professionals who are expert in testing environmental technologies and operating the on-site environmental control equipment
    - Undergo scrutiny from the local community, including appropriate mechanisms for public participation on an ongoing basis
    - Have in place a RCRA corrective plan to address any potential remediation that could be required as a result of releases or testing failures.

4. **EPA'S Office of Research and Development (ORD):** *The resources and expertise of ORD should be used to assist permit writers to devise realistic and flexible, yet fully protective, permit conditions for testing centers.* ORD should also provide technical assistance to testing center operators. ORD's own testing facilities should be made available to testing center permittees, perhaps through Federal Technology Transfer Act (FTTA) agreements. A guidance document for such facilities could be prepared by ORD. (See also subrecommendation 4.4 for more details.)

d. LOCATION AND OPERATION OF TESTING CENTERS: *EPA should investigate the potential for establishing federal testing centers at EPA facilities and at other federal locations, such as Department of Defense (DOD) or Department of Energy (DOE) sites.* Sites which are in isolated areas, away from vulnerable environments and high population centers, would be most desirable. The Department of Commerce's National Institute of Standards and Technology (the old National Bureau of Standards) could also be a participant in establishing and guiding federal testing centers.

Testing centers could also be established under non-governmental auspices, such as private companies, universities, and other research institutes. EPA should fully utilize the provisions of the Federal Technology Transfer Act in setting up such centers at quasi-public or private facilities. EPA should assure that reasonable provisions and licensing are made for ownership and licensing of intellectual property, such as patents and trade secrets at public and private test centers. It should also be noted here that testing centers could be for manufacturing process innovation or for pollution control and remediation innovation. In the former case, testing centers are likely to be operated by individual companies, by industry associations, or by other organizations created for that purpose.

1.3. Develop a system for cross-media and cross-jurisdictional coordination of the review of permit applications for (a) testing facilities and (b) tests at other locations.

Commentary

The TIE Committee recommends that steps be taken to achieve coordination of testing permit activities. Even if permitting systems for testing innovative technologies for environmental purposes were in place in each of the media-specific programs and at the federal, state, and local levels, coordination would be needed to assure that they can be used effectively. Such coordination is critical to the encouragement of innovative pollution prevention technologies in that it is needed to achieve consistency, timeliness, efficiency, clarity, and predictability.

a. THE NEED FOR CROSS-MEDIA, CROSS-JURISDICTIONAL COORDINATION: The importance of this recommendation lies in the fact that the TIE Committee has found that individuals, firms, universities, and others wishing to test innovative environmental technologies:

- Have frequently been significantly and apparently unnecessarily slowed by permitting processes
- Have encountered conflicting attitudes and requirements at different levels of government
- Have spent large sums applying for permits, perhaps unnecessarily
- Have only had mixed success in the end.

The Committee heard many case studies and examples of these problems. It can easily cost millions of dollars to apply for the several permits necessary to conduct a test of an innovative technology. An innovative technology itself may cost considerably less than a million dollars to purchase. Obtaining these permits can take two years or more and involve application to and negotiation with several agencies at more than one level of government. Additionally, if use is proposed in another state, the entire process may have to be undertaken again at a substantial fraction of the cost and time.

b. A PROCESS FOR ACHIEVING COORDINATION: *In implementing this recommendation, the Committee recommends that a working group be established that includes the appropriate EPA offices, including all of the key categorical programs, plus a number of state and local agencies.* This working group should be tasked with describing the detailed implementation steps that are necessary, including potential statutory changes. The TIE Committee believes that this task can be completed within 9 to 12 months of its inception. Operating guidance should be developed by EPA and provided to regional offices and to state and local governments to encourage, if not assure, a consistent coordination effort.

It is important that, as a part of EPA's efforts, methods be devised to assure an early and substantive role for the public. Such an approach is necessary to building public confidence that public health and the environment will not be subject to unacceptable risk when new technologies are undergoing trials and testing.

c. FEDERAL AND STATE ROLES: _The TIE Committee recommends that serious consideration should be given to new authority that divides and coordinates the responsibility for overseeing testing among the levels of government_. Under such a division of responsibility, the federal government might appropriately develop technology-specific permitting conditions from a national perspective, while state and local governments might develop site-specific permitting conditions for tests proposed within state borders. National applicability of the data could thus be assured, and data sharing could be made easier, while state and local governments could consider the applicability of a technology to a proposed site and site-specific risks associated with its testing determining whether a proposed test would be allowed to proceed. National technology permits could be modeled on those issued by EPA for TSCA mobile treatment units.

d. THE PROCESS OF PERMIT APPLICATION REVIEWS BY TEAMS: Various mechanisms for coordinating permitting of technology tests are being tried in several states (e.g., Massachusetts, New Jersey). These may involve coordination of the reviews of independent permitting programs through various forms of teaming or a combined, multi-media review by one qualified person or a small team assembled under a special office. Other mechanisms are conceivable. *The TIE Committee recommends that, at a minimum, a team concept be adopted by EPA so that federal responsibility and accountability for the review of permit applications for tests of innovative technology and for testing centers is unified within the Agency and so that a single point of contact exists for use by the involved state and local agencies.* Ideally, the teams should be well-coordinated across the levels of government and, within EPA, from region to region. This could help alleviate the frustration and confusion mentioned frequently by the case studies heard by the Committee during its Fact Finding process.

e. "TECHNOLOGY ADVOCATE" NEEDED: _The TIE Committee recommends that a "technology advocate" function be established._ This function would provide a single point of contact for technology developers, prospective users of innovative technology, permit writers and compliance officers at all levels of government, and the public. The "technology advocate" would provide four key kinds of information:

1. The policies relating to technology innovation

2. Permitting processes relevant to proposed tests, demonstrations, or uses of an innovative technology

3. The status of permit applications -- for individual tests and demonstrations, testing centers, and early commercial uses -- at both federal and state agencies

4. The results of tests, demonstrations, and early commercial uses of innovative technologies, including information about the performance envelopes of individual technologies.

To be successful, the "technology advocate" will need to have the ability to work at all levels of government -- national, regional, between and within states, and locally. The "technology advocate" function could also profitably include the ability to intervene to encourage timely consideration of permit applications or even to mediate between permit applicant and permit writer. (See also subrecommendation 4.4.)

Concluding Comments: Recommendation 1

The program outlined above needs first and foremost to have as its motivating force a strong and clear EPA policy that promoting technology innovation is a part of the Agency's mission. NACEPT has previously recommended (January 1990, TIE Committee Recommendation 1.1) that the Administrator of EPA develop and issue a policy statement redefining the Agency's mission to include fostering the development and diffusion of innovative technologies that both further the Agency's environmental objectives and enhance the competitiveness of the United States economy. The TIE Committee reiterates that recommendation.

Recommendation 2:

Implement permitting processes that aid the commercial introduction of innovative technologies for environmental purposes.

2.1 Increase the flexibility of permitting processes involved in introducing environmentally beneficial technologies into commercial use.

2.2 Streamline the process of reviews of permit applications for newly introduced innovative technologies that have environmental benefit, coordinate their review, and afford them high priority.

2.3 Assure national consistency in the consideration of proposed uses of innovative technologies, subject to site-specific limitations.

2.4 Develop a system of incentives for users of commercially-available innovative technologies.

2.1 Increase the flexibility of permitting processes involved in introducing environmentally beneficial technologies into commercial use.

Commentary

The Committee believes that EPA should undertake a number of measures to ensure the necessary flexibility in permitting processes to promote environmental technology innovation. Some of them can be accomplished under existing authorities and some will require legislation. In summary, however, EPA and most other environmental regulatory agencies have interpreted existing permitting and compliance authorities in a way that limits flexibility and, thus, discourages technology innovation for environmental purposes. It should be noted that some of these measures are more critical for pollution prevention technology innovation, some for pollution control technology innovation, while some would promote both. Specific measures include the following:

a. REVITALIZED WAIVER AUTHORITIES: EPA should make a policy and organizational commitment to promote environmental technology innovation through revitalization of its innovation- and regulatory-waiver authorities. This step would assist in encouraging the development of innovative pollution control technology. It could potentially have its greatest impact, however, in removing barriers to implementation of innovation resulting in the prevention of pollution, and the Committee strongly recommends that EPA explore this potential. NACEPT has previously recommended (January 1990, TIE Committee Recommendation 1.4.h) that the Administrator expand the use of statutory provisions such as the "Innovative and Alternative Technology" waiver under the Clean Water Act (CWA Section 301(k)) and innovative technology waivers (CAA Section 111(j)) under the Clean Air Act. The Committee reiterates this recommendation. The effective use of these authorities could help EPA realize some of the significant increase in flexibility required to encourage environmental innovation.

The Committee found that while EPA has had authority to grant innovation waivers under both the Clean Air Act and the Clean Water Act for over a decade, there has been very limited use of these provisions. Regarding the CWA, 301(k) waivers may be used to extend BAT technology based compliance deadlines, where the permittee proposes to use innovative production processes or innovative control techniques to meet the applicable control requirements. Alternatively, an *ad hoc* process now operates: a prospective innovator can get a regular discharge permit, do research, and make control technology changes "at their leisure." However, if they propose to significantly change their production line or production process, then permit modifications may be needed. Other variance authorities, some of which might also be useful in the context of encouraging multi-media pollution prevention technology innovations, have also been very low on the Agency's list of priorities. The Committee believes that, in combination, these authorities could provide a powerful tool for encouraging plants to make environmentally-sound decisions to cut back releases to all media. *To make these statutory and regulatory authorities an effective tool for promoting both environmental innovation and pollution prevention, the Committee believes that EPA should take the following, interrelated steps:*

- Make a high-level policy commitment to maximizing the potential for promotion of pollution prevention innovation in current and future authorities. *The Committee commends EPA for its actions to make a commitment to pollution prevention.* These actions include establishing the Pollution Prevention Office, the development of a pollution prevention strategy, the drafting of pollution prevention legislation (although it should be noted that the Committee did not review its specific terms and, therefore, is not implying its support or rejection of any individual terms), and the initiation of several "pollution prevention initiative projects"

- Establish an organizational focus charged with revitalizing the Agency's powers for promoting innovation within these programs, and involving the active participation of individuals from the relevant programs
- Establish working groups in each region with the responsibility of integrating this approach into regional operations, including permitting and enforcement
- Develop guidance for evaluations of waiver applications, particularly in a multi-media context and including criteria for success linked clearly to pollution prevention objectives, and establishing a basis for performance evaluations against those criteria at all levels within the Agency with responsibility for the effort
- Provide incentives within the Agency for individuals to work for the success of regulatory incentives for environmental technology innovation, with special emphasis on looking for opportunities for innovations in pollution prevention (see recommendation 4)
- Promote joint, cooperative efforts to promote similar programs at the state level, since active state participation and support is a prerequisite for such a program to work
- Develop a technology transfer and outreach effort to communicate the Agency's new objectives and programs to industry, and to emphasize that this has a high priority at EPA.

b. CREATE A "SOFT LANDING" POLICY: *EPA should adopt policies that allow a "soft landing," consistent with leal and regulatory requirements to protect human health and the environment, for good-faith efforts which fall minimally short of compliance requirements.* Such policies would complement innovation waiver programs in promoting either pollution prevention or pollution control (see subrecommendation 3.2). Where permits providing for innovation waivers are approved, the Committee believes that it is important to provide for "soft landings," i.e., to avoid punishing good faith efforts. The need for such a mechanism would occur when a permittee makes a good faith effort to use an innovative technology to meet the permit requirements, but falls short, minimally, resulting in no significant public health or environmental damage. In such a case, to encourage permittees to use innovative technology, efforts should be made to minimize penalties for non-compliance or eliminate them completely, and additional time should be allowed to achieve compliance where possible. ("Soft landing" opportunities would not be appropriate, however, where criminal violations are involved.)

The TIE Committee commends the concept in EPA's Enforcement in the 1990s Project that more opportunities should be provided for the use of innovative technology in the enforcement process, through the use of penalty reductions and extended compliance schedules. In particular, the Committee commends the policy of allowing more time to come into compliance if a violation arises out of a pollution prevention activity. This should provide more opportunity to experiment with innovative technological approaches involving changes in the production process.

c. REPERMITTING OF FACILITY CHANGES: *To the extent consistent with its current authority, EPA should seek to reduce the permitting burden for the introduction of new technologies (see subrecommendation 2.2) and should explore the potential for statutory provisions which would reduce such burdens.* One area of particular concern for the Committee was the extent to which the installation of innovative technology for either pollution prevention or pollution control at existing facilities might be discouraged by the necessity of obtaining new permits. More-polluting older technologies are often kept in place, even when it might be economical to replace them, simply because of the perceived cost, complexity, and uncertainty of having to go through the permitting process for the replacement technology.

d. CAA NEW SOURCE REVIEWS: The Committee also heard comment in its Fact Finding activities about the perceived risk facility owners take in triggering New Source Review (NSR) review in non-attainment areas when participating in innovative technology demonstration projects, such as might occur in the EPA/DOE Clean Coal Technologies Program. The Committee learned that EPA is currently preparing an interpretive ruling which will clarify that if a source solely adds or enhances a system or device whose primary function is the reduction of air pollution, and which is determined to be not less environmentally beneficial, such activities do not constitute a physical or operational change triggering new source requirements. *The Committee applauds OAQPS for initiating this interpretive ruling.* It recommends, however, that more aggressive efforts be undertaken to educate the regulated community of its existence to ensure that perceived barriers do not prohibit facilities from demonstrating and eventually adopting innovative and environmentally beneficial technologies.

e. CAA NETTING POLICY: *The Committee has found that EPA's netting program under the Clean Air Act (prior to passage of the 1990 amendments) can help reduce the permitting burden for new pollution prevention or pollution control technologies.* The Committee noted, however, that some states have not adopted EPA's approach to netting in non-attainment areas. While the Committee recognizes that LAER requiring diffusion of the most effective current control technology, the Committee feels that netting plays a valuable role by allowing a new technology to be introduced under a less stringent and cumbersome review process whenever the plant at which the new equipment is being introduced can find enough emission reductions elsewhere at the plant to avoid significant increases in overall emissions as a result of the new equipment. The rationale for netting is that increased emissions which do not exceed the significance levels do not warrant the time-consuming, resource-intensive New Source Review process. *For those states which have not adopted EPA's netting program, EPA should consider working with the states to define criteria, at a minimum, for innovative pollution prevention technology to which the netting program would apply.*

f. RCRA CORRECTIVE ACTION TRIGGER: *The TIE Committee recommends that, under selected conditions, corrective action requirements not be triggered by the application for permits under RCRA.* EPA has already determined that owners and operators who receive RD&D permits under RCRA section 3005(g) do not trigger corrective action. This determination should, at a minimum, be extended to include the application for permits for early commercial uses of innovative technologies. EPA should consider this recommendation in the RCRA reauthorization process, if it concludes that it lacks sufficient flexibility to otherwise address this need

g. PERFORMANCE-BASED PERMITS: *The TIE Committee recommends that, within statutory constraints, the Agency should adopt regulatory changes to place all of its permit requirements on a performance basis. In addition, statutory changes should be considered.* While most permits issued under EPA programs are stated in terms of performance standards, even though the standards are based on estimates of the performance capabilities of specific technologies, some standards are stated in terms of technology requirements. The Committee believes that technology-specific requirements in permits eliminate alternative options for meeting standards, inhibiting the development of innovative technology.

h. SUPPORT TO PERMIT WRITERS: *The TIE Committee recommends that a systematic program be instituted to encourage, support, and train permit writers involved in permitting activities associated with the testing of innovative environmental technologies (see subrecommendation 4.1 for details).* Without such a program, permit writers will lack the institutional sanction and encouragement and the supporting resources necessary to realize the benefits of the above actions. The Committee specifically endorses the RCRA Implementation Study recommendation that the Agency should give credit in management systems for RD&D permits.

2.2 Streamline the process of reviews of permit applications for newly introduced innovative technologies that have environmental benefit, coordinate their review, and afford them high priority.

Commentary

A streamlined permitting process is important if newly introduced innovative technologies that have environmental benefit are to be moved more successfully from demonstration into commercial use. The TIE Committee has concluded that an early dialog between permit writers and the technology developer or prospective user of an innovative technology should be encouraged to minimize misunderstanding by both parties, shorten the permit process, and reduce costs. Equally, the Committee sees an early dialog as being critical to effective and positive public participation in the consideration of permit applications for innovative technologies [see subrecommendation 4.5]. These suggestions derive from two, interlocking barriers to the use of innovative technologies: unfamiliarity with the innovative technology by permit writers and the local community.

a. TWO-PHASE PERMIT PROCESS: *The Committee recommends that environmental policy makers, in developing a strategy for streamlining permit reviews involving the early commercial use of innovative technologies, consider instituting one that is comprised of two distinct phases, or tiers.*

During the first phase, basic principles and parameters associated with the operation of the proposed innovative technology would be discussed at the earliest possible time. The permit writer would then be able to gain a better understanding from technical experts (e.g., from ORD) and seek answers to and resolutions of any outstanding issues (e.g., obtain additional environmental, health, risk, or efficiency data). The permit writer would also be able to discuss the concepts with the interested public. If no agreement is possible, this fact can often be identified during the first phase. In this case, a decision to modify or abandon a project could be made earlier, before regulators and applicants have expended as much time and resources as would be needed if a complete permit application has to be provided before consideration could begin.

During the second phase, detailed technical information would be discussed to establish permit conditions and a compliance schedule, and to reach a conclusion about whether a permit will actually be issued. Deliberations during this phase would not reopen issues covered successfully in phase 1. The public would also be deeply involved in the second phase.

The goal of the TIE Committee's recommendations for a testing permit system (see subrecommendations 1.1 through 1.3) is to remove as much uncertainty as possible about the potential performance of a proposed operating use of a newly introduced (yet already tested) technology. The problem addressed by this recommendation is the difficulty of obtaining an operating permit for an already-tested innovative technology for which little operational data exists.

b. COORDINATION, INTEGRATION OF PERMITTING PROGRAMS: Coordinated review is especially appropriate at the time of first introduction of a new technology, since permit writers and the public will be unfamiliar with that technology and have a higher level of concern than for a well-proven technology. This was recognized by NACEPT in the TIE Committee's January 1990 recommendation 1.4.c that EPA work to maximize coordinated permitting strategies across environmental media, and increase intergovernmentally-coordinated permitting whenever possible, within the constraints of existing statutes.

The Committee has developed a great deal of information that supports this view. During the Committee's recent Fact Finding meetings, EPA's Office of Pollution Prevention (OPP) gave a presentation describing the progress of EPA's "pollution prevention through permitting" initiative. Specific case studies presented included the project at Amoco's Yorktown, Virginia, refinery, at which a multi-media environmental evaluation will be performed. At the state level, fact finding presentations from Massachusetts and New Jersey described those states' multi-media pollution prevention efforts, including integrated permitting and coordinated inspections. The Committee heard a report on the Blackstone Project recently conducted by the Massachusetts Department of Environmental Protection. Under that project, multi-media inspection teams under a team leader were assigned to inspect individual facilities. The team leader was often chosen on the basis of the primary medium for facility releases. The state is examining the potential for applying this process to permitting, as well. *The Committee commends the Agency for the financial support it has provided for this innovative program under the Pollution Prevention Incentives grant program, and urges the Agency and states to explore the wider application of this approach.*

The Committee reiterates its recommendation that a system for coordinated and integrated permitting be devised for easing the introduction of new technologies into the marketplace. Major features of a program for the coordinated review of permit applications for innovative technologies might include the following:

- A mechanism for *expedited joint review* across federal, state, and local authorities. Contemporaneous public hearings would be one time- and resource-saving device.
- *Permit teams* that could provide "one-stop shopping" for permits across all affected media. In addition to simplifying the often complex permit application process (different forms and data formats, and different submission and reporting requirements), the one-stop process would allow for careful tracking of permits. Perhaps more importantly, the team approach also has the benefit of less disruption when one team member leaves. The rest of the team will be able to bring the replacement up to speed in much less time, eliminating the possibility that applicants will have to go back to "square one."
- Use of *a technical resource ombudsman* as outlined in subrecommendations 1.3 and 4.4.
- *Incentives for fast-track processing* to assure timely response on a predictable basis. *A key element of a fast-track process is a systematic program to encourage, support, and train permit writers involved in permitting activities associated with testing (see subrecommendation 4.1 for details).*

c. THE PERMIT TEAM CONCEPT: *The TIE Committee recommends that the permit review team concept be adopted by EPA so that responsibility and accountability for the review of permit applications for the use of new technologies is unified within the Agency and with involved state and local agencies. EPA should encourage states to adopt this approach. Team members should include appropriate representatives from each of the major media program offices (RCRA, water, air, and, potentially, TSCA) at the federal, state, and local levels. Technology expertise from ORD should also be represented, perhaps in the role of technology ombudsman (see subrecommendation 4.4). Another important team member would be someone with public participation expertise whose primary role would be to assist the public if questions arise about regulatory process or whether the new technology will be protective of human health and the environment in the proposed use (see subrecommendation 4.5). One member of the team would be designated team leader to serve as client contact (for the new technology permit applicant) and to coordinate team efforts.*

d. TOP PRIORITY STATUS FOR REVIEW OF PERMIT APPLICATIONS INVOLVING INNOVATIVE TECHNOLOGIES: One of the barriers to coordinated and concurrent permitting is that each single-medium statute contains its own individual permit requirements and compliance deadlines, along with separate schedules for renewal or review of existing permits. For example, under many state air pollution control programs, written approvals are required before construction of a new source or a source modification may begin. Resulting delays of six months to a year are frequent. Such delays may preclude innovative technologies from ever getting to market -- especially environmentally beneficial manufacturing technologies in rapidly changing industries. The TIE Committee heard several examples where permit application reviews for a project were completed in one or more media, but not in all media so that the project was delayed substantially. The permit team might be given the flexibility to provide limited modifications to nonsubstantive regulatory requirements, e.g., those involving timing. In all cases involving technology innovation, every effort must be made to streamline the application and permit approval process so as to not miss the narrow "window of opportunity" during which the commercial success or failure of the introduction of an already-tested technology is determined.

The Committee heard from many sources that permit applications involving innovative technologies are frequently assigned lower priority than those involving well-known solutions. *The TIE Committee recommends that, either with or without the benefit of the permit team program, permit applications for the introduction of innovative environmental technologies be given the highest priority in terms of timely review. The combination of permitting complexity and slow permit approval causes a great barrier to the diffusion of new technology.*

e. STREAMLINED CAA SMALL SOURCE PERMIT REVIEWS: The Committee notes another factor impeding technology innovation for environmental purposes: permit writers in some state programs do comprehensive reviews for even small sources of air pollution. *The Committee recommends that the Agency promote streamlined review processes for small or very small sources, and that the Agency encourage states to give innovative proposals and prevention projects preference when scheduling reviews of permit applications.* The combination of these suggestions will increase the efficiency of permitting programs, freeing up scarce governmental staff time for higher value uses. Some states, including Massachusetts, have modified permit review processes to minimize the time required to approve very small air pollution sources (0 - 1 tons/year; 1 - 5 tons/year -- see CMR 7.02 [4][a]). Some off-the-shelf equipment may be exempted from comprehensive review, if it meets performance standards, e.g., solvent degreasers or dry material storage silos. This action to cut the permit review backlog supports innovation by reducing delays. Further, Massachusetts sources which propose innovative prevention or control strategies can have their permit applications moved to the front of the approval process queue.

2.3 *Assure national consistency in the consideration of proposed uses of innovative technologies, subject to site-specific limitations.*

Commentary

The TIE Committee recommends that EPA take steps to ensure, to the greatest extent possible, consistency in the review and evaluation of proposed uses of innovative technology, subject to site-specific variations, across jurisdictional boundaries, and within relevant geographic units. In addition, EPA should take steps to eliminate repetitive and potentially inconsistent repermitting requirements for mobile treatment units' non-site-dependent features.

a. THE NEED FOR CONSISTENCY IN THE REVIEW OF PERMIT APPLICATIONS: The information developed in the Committee's Fact Finding process indicates that consistency in the evaluation of innovative environmental technologies is of great importance both for pollution prevention and pollution control. Potential market size is a critical factor in decisions about whether to invest in the development of any innovative technology. Inconsistencies across regions or among different levels of government reduce potential market size by increasing uncertainty among potential users of a technology that it will actually be acceptable to permit writers.

b. AN EXAMPLE: MOBILE TREATMENT UNITS: Mobile Treatment Units (MTUs) provide a specific example of technologies potentially subject to multiple and inconsistent reviews of the basic technology, independent of appropriate and necessary site specific considerations. It is generally agreed, based upon the Committee's Fact Finding meetings, that in many cases it is environmentally preferable to move a mobile incinerator from place to place rather than transport hazardous waste substantial distances for treatment at a stationary incineration unit. Yet site-specific permitting militates against this.

The TIE Committee recommends that some of the current constraints on the use of MTUs be removed. In making this recommendation, the Committee recognizes EPA's

TSCA nationwide permits for mobile PCB incinerators. The Committee heard a presentation from California on that state's successful permitting and utilization of MTUs, for California's non-RCRA hazardous wastes, through the use of state-wide Permit-By-Rule (PBR) mechanisms. California's approach is not available for RCRA wastes within that state. *The Committee recommends that EPA review the California approach, and consider the regulatory and/or statutory changes which would be required to implement such a system for RCRA hazardous wastes.* The Offices of Solid Waste and General Counsel might be tasked with this job.

c. THE IMPORTANCE OF EXPERT REVIEWERS OF PERMIT APPLICATIONS: One factor the Committee believes can lead to inconsistent consideration of innovative technologies is the lack of adequate technical expertise in each of EPA's regions to review all the relevant technical features of a proposed innovative technology, which may have had trials in only a few locations in the entire country. This problem is compounded when federal and state permit writers are involved. The recommendations in 2.1 with respect to innovation waivers are intended to address this problem by ensuring the development of a central organizational unit with the responsibility of providing consistent review of technical factors. The recommendations in 4.1 with respect to support to permit writers are intended to address this problem by elevating the priority of permits involving innovative technologies and by providing needed technical assistance and training.

d. NATIONAL GUIDANCE TO PERMIT WRITERS: Another factor in the inconsistency among EPA regions in evaluations of permit applications involving innovative technologies has been the lack of any general EPA guidance on the principles and objectives which should govern the review of permit applications requiring innovation waivers. In the absence of such a clearly articulated national policy, each regional office, and in fact each individual permit writer, is likely to make different determinations of the relative environmental benefits which should be required from an innovative environmental technology. Moreover, the lack of a strong signal from EPA has led to an inconsistent, and generally weak, set of state policies for the use of innovative technologies.

In addition, EPA should, whenever possible, indicate geographical areas to which common technical performance requirements are applicable. Examples of such areas might be severe non-attainment areas or geologically sensitive areas of a large aquifer. Identifying industry categories appropriate for new technologies might also be warranted.

Since decisions by state and local jurisdictions are also vital in any effort to achieve consistency, the Committee urges EPA to (a) issue strong guidance encouraging the use of innovative technologies and (b) develop a system for working closely with state and local jurisdictions in considering permit applications involving the use of innovative environmental technologies. The guidance should address the need to assure substantive, early public involvement (see subrecommendation 4.5). This guidance would also address (a) the development, to the greatest extent feasible, of common standards for evaluating proposed uses of innovative technologies, (b) the provision of technical assistance by EPA to states, localities, and the public requesting technical support in the review of permit applications proposing use of such technologies (see subrecommendations 4.1 and 4.5), and (c) the provision of support to both the applicants and the suppliers of innovative technologies involved in the permit application (see subrecommendation 4.4).

e. RCRA SUBPART X, AN OPPORTUNITY: The federal RCRA Subpart X regulation was originally intended for use in providing flexibility in the permitting of non-conventional treatment units, such as MTUs. The lack of specific standards, however, in the Subpart X regulation and the absence of clear guidance to permit writers have hampered the full utilization of this authority for permitting transportable units. The RCRA Implementation Study specifically noted the need to develop supplemental guidance for Subpart X. In its January 1990 recommendations, the TIE Committee recommended that EPA investigate how RCRA Subpart X regulations could be used to facilitate the use of miscellaneous treatment technologies.

In light of the California program and EPA's own TSCA experience, the TIE Committee recommends that EPA investigate a permit by rule (PBR) mechanism, perhaps within RCRA Subpart X, to allow the consistent nationwide utilization of MTUs where such use is appropriate, for RCRA hazardous waste. The Committee notes that the RCRA Implementation Study makes a similar recommendation and suggests that the Offices of Solid Waste and General Counsel might be tasked with conducting this investigation and reporting its results (and proposed recommendations to be taken on the basis of its results) to the Administrator. *The Administrator should also identify other opportunities to introduce flexibility into permitting systems that can be applied to aid the introduction of innovative environmental technologies and, if sufficient opportunities do not exist, should seek additional statutory provisions, not limited to RCRA.*

2.4 Develop a system of incentives for users of commercially available innovative technologies.

Commentary

Current statutory provisions for innovation waivers are generally designed to provide extra time for regulated organizations using innovative technologies to come into compliance with statutory or regulatory requirements. These provisions are thus meant to provide an incentive (or eliminate a disincentive) for organizations to implement innovative approaches to reducing pollution. Industry experience with federal and state implementation of innovation waiver and variance programs, however, has resulted in considerable skepticism about the seriousness of such efforts. In addition, if an effort to implement innovative technology falls short of a requirement, by however narrow a margin, EPA and states typically have not had any policy other than requiring full implementation of the standard alternative for achieving compliance (see subrecommendation 3.2).

a. ESTABLISH AND COMMUNICATE AGENCY SUPPORT FOR THE WAIVER PROGRAMS: *For the innovation waiver programs to work as an effective incentive, the TIE Committee recommends that EPA and states communicate to industry and other regulated organizations that any regulatory flexibility effort designed to promote environmental technology innovation is the result of a top-level decision, that there are clear criteria for evaluating the chances of success of an application, and that the responsible Agency has assigned adequate resources to carry through on its objectives*.

b. DESIGN APPROACHES FOR "SOFT LANDINGS": *EPA should design approaches for "soft landings" for good-faith efforts to implement innovative alternatives that fall marginally short of regulatory objectives. EPA should work with regional offices and state agencies to implement these approaches*. The Committee believes that, in many cases, the authority to institute such approaches already exists and, in some case, regulatory repertoire. For example, in certain cases the emissions trading and offset programs could be used to create a bubble, enabling facilities that would otherwise fall marginally short of meeting such requirements at the conclusion of innovation waiver compliance delays to meet these regulatory requirements. In other cases, new authority may be needed. While current law, or at least operating interpretations of that body of law, have placed limits on the extent to which EPA feels able to use approaches such as "soft landings," the Committee believes that flexibility under the law is often greater than recognized, and the real extent of statutory limitations can only be determined through a concerted effort to utilize innovative enforcement to promote innovative technology.

c. THE ROLE OF ECONOMIC INCENTIVES FOR INNOVATION: *The Committee believes that EPA and states should consider more extensive use of economic incentives to encourage environmental innovation.* Where the cost of compliance or the cost of using environmentally harmful materials substantially increases, industry will have a strong incentive to invest in developing alternative technologies or materials, even in the absence of performance-based or technology-based standards. The prohibition against land disposal without treatment, for example, appears to have significantly encouraged industry to innovate for pollution prevention, because of increased costs of compliance. *It is likely that the economic factor will do more to encourage investment in innovative pollution prevention processes than would any specific regulatory requirement applied to process equipment.* Similarly, many states are now considering taxes on volumes of chemical releases reported in the Toxic Release Inventory. One of the objectives of such a tax is to provide an incentive to industry to reduce the use and release of toxic chemicals.

d. RECOGNITION FOR INNOVATORS: *Another incentive EPA should consider is a special effort to recognize companies that adopt innovative environmental technologies -- perhaps particularly in the context of pollution prevention.* Such a program is likely to be effective, if it is well conceived and run, because many corporations place significant value on recognition for corporate activities which benefit the public and particularly the environment. One component of a broad program to recognize companies and other organizations that adopt innovative solutions could profitably be an awards program, potentially one expanding on EPA's commendable pollution prevention awards.

e. INCENTIVES FOR PERMIT WRITERS: *A system of incentives for permit writers should be instituted (see subrecommendation 4.1).* Such a system will complement the system of incentives for users of innovative technologies by increasing the receptivity of permit writers to applications proposing the use of innovative solutions.

f. INCENTIVES FOR PROSPECTIVE PERMITTEES: *Subrecommendation 4.3 discusses other types of support that would be important to prospective innovative technology permittees.* These primarily involve information systems and technical support, but also include the ombudsman function.

Recommendation 3:

Use compliance programs to encourage use of innovative technologies to solve environmental problems.

3.1 Modify environmental compliance programs to create an expectation of the need to comply.

3.2 EPA and state agencies should practice and encourage flexibility in the choice of remedies during enforcement actions, aiming at encouraging the use of innovative technologies under appropriate circumstances.

3.3 EPA, state agencies, and other regulatory authorities should institute mechanisms to increase coordination in compliance programs across media and across jurisdictional lines.

3.1 Modify environmental compliance programs to create an expectation of the need to comply. This is necessary to create markets for innovative technology.

Commentary

a. THE NEED FOR FIRM AND PREDICTABLE ENFORCEMENT: *The Committee stresses the importance that industrial, commercial, and other facilities subject to environmental requirements expect routine and rigorous enforcement of permit requirements. Otherwise, most will not purchase and use innovative technologies. Without the expectation of the need to comply with environmental permit requirements, the market stability and consistency necessary to promote innovative environmental technology will be lacking.* Environmental compliance systems that are consistent and predictable provide an incentive for the development of both pollution control and pollution prevention technology because they assure that a market for such technologies will exist (and be of predictable size and character). *As is the case under EPA's current penalty policies, penalties must be sufficient to remove any economic benefits a facility might gain from non-compliance.*

Such an approach to enforcement and compliance is fully consistent with the flexibility inherent in providing in permit conditions limited time delays, in the form of waivers for genuine, good-faith efforts, to develop and implement innovative technology. But it is important that the criteria for such waivers be clear and consistent, so that waivers cannot in any way be used as vehicles for avoiding compliance by facilities which are not genuinely attempting to implement an innovative approach and/or provide an overall, multi-media environmental benefit.

b. STATE EXPERIMENTATION WITH PREDICTABLE ENFORCEMENT: EPA can promote the necessary market consistency both through firm and predictable enforcement actions, and through support for and coordination with state and local enforcement efforts. One role which EPA is in an especially strong position to play, and which the Committee believes would be of great value, is to track innovative state and local enforcement programs which are trying new approaches to providing consistency, predictability, and multi-media inspection and permitting of entire facilities, and providing information and communication between programs in different parts of the country. A number of new experiments in enforcement are currently underway in various states and localities, e.g., Minnesota, Massachusetts, South Coast Air Quality Management District (in California). EPA should promote the sharing of information on the successes and problems of these efforts.

The Committee notes that, with most compliance activities taking place at the state and local levels, NACEPT's State and Local Programs Committee could appropriately undertake a project leading to widespread implementation of the recommendations in 3.1.

3.2 EPA and state agencies should practice and encourage flexibility in the choice of remedies during enforcement actions, aiming at encouraging the use of innovative technologies under appropriate circumstances.

Commentary

As noted above in recommendations 3.1 and 2.4, both incentives and firm enforcement play an important role in creating a stronger market for innovative environmental technology. *Flexibility in meeting environmental compliance requirements is essential to provide the freedom necessary to make the initial commercial applications of promising innovative pollution control or pollution prevention technologies. The TIE Committee believes strongly, however, that flexibility only works in a context of strong* *enforcement and meaningful penalties, so that there is no reward for making a perfunctory effort to comply.*

a. THE NEED FOR FLEXIBILITY: *Within a strong enforcement context, the Committee believes that flexibility is essential when innovative technologies are involved.* Innovative approaches which may provide long-term environmental benefits often cannot meet short-term compliance deadlines. In addition, multi-media benefits which might result from innovative environmental technology are not addressed by EPA's and states' media-specific programs. Further, the potential for a risk management strategy that is multi-media in scope can only be possible if greater flexibility is instituted in operating guidance and, potentially, statutory language. Flexibility in compliance situations is necessary when innovative technologies are involved because these technologies are inherently less certain than conventional technologies.

b. MECHANISMS FOR ENFORCEMENT FLEXIBILITY: In order to deal with these factors, it is important to have an effective program for environmental waivers and variances (as discussed in recommendation 2.4), with provisions for soft landings and for the creative use of compliance penalties, to the extent consistent with legal and regulatory requirements to protect human health and the environment, for good-faith efforts which fall minimally short of compliance requirements. In particular, where the Agency and/or a state deems that an attempt to implement an innovative technology has met clearly delineated criteria for a good-faith effort, the punitive portion of penalties might be reduced for some predetermined period during which the facility would be required to come into compliance by improving the performance of innovative technologies or through the use of more traditional technologies.

c. SUPPORT: *It is important that support of various types be provided to compliance personnel in federal and state agencies.* Subrecommendation 4.2 discusses a system of support that is recommended by the TIE Committee.

3.3 EPA, state agencies, and other regulatory authorities should institute mechanisms to increase coordination in compliance programs across media and across jurisdictional lines.

Commentary

EPA should work to maximize coordinated permitting strategies across environmental media, and increase intergovernmentally-coordinated permitting whenever possible, within the constraints of existing statutes. NACEPT has previously recommended (January 1990 TIE Committee Recommendation 1.4.b) that EPA identify, develop, and apply ways to use compliance and enforcement policies to encourage technology innovation, including commercial adoption of new technologies. The Committee also supports many proposals in the *Enforcement in the 1990s Project* to develop criteria and guidance for enforcement focused on multimedia and risk management strategies, and to explore the policy and statutory revisions necessary to better realize those approaches. The Committee urges the agency to make these efforts a high priority. Note that this recommendation (3.3) is closely related to subrecommendation 2.3 (also previously recommended in the January 1990 TIE Committee Recommendation 1.4.c).

a. MULTI-MEDIA INSPECTION TEAMS: *A multi-media approach to compliance would include the development of multi-media inspection teams, and the development of consent agreements or other enforcement actions which take into account potential reductions in pollution to all media -- not just the single medium (where that is the case) where a facility is discovered to be in violation.* The Committee notes the several state initiatives in this area. Such an approach reduces the incidence of cross-media transfers which have often been the result of narrow enforcement actions against single-media violations. It is also an effective means to encourage innovations in pollution prevention technologies, since it encourages facilities to look for overall changes in production methods and materials usage, not simply to install available add-on controls to correct the immediate violation. Consent agreements can be designed to provide the extra compliance time necessary to design and implement such multi-media changes. They can also be used to require facilities to undertake multi-media pollution prevention planning. This can improve the facility's analysis of its own future pollution prevention opportunities, whether through innovative process or materials changes, or standard improvements in operating procedures.

b. USE OF PENALTY MONEY: In some cases, it might be appropriate to allow monies derived from civil penalties (for compliance violations) to underwrite technology innovation, particularly where such innovations could result in improved environmental performance by a significant class of industrial facilities. This has been done, for example, in Minnesota, where a portion of the penalties for violations of pre-treatment requirements by electroplaters and metal finishers was allocated to the development of an innovative central metals treatment and recovery facility. In Southern California, $1 million from enforcement penalties is being set aside as an Air Quality Assistance Fund to support innovation and to guarantee loans to smaller businesses for installation of compliance technologies. Implementation of such an approach at the federal level will likely require statutory changes to allow for specific allocation of funds collected in penalties. *The Committee recommends that the agency seek the requisite statutory revisions.*

c. CROSS-JURISDICTIONAL COORDINATION: For efforts that attempt to use compliance and enforcement to promote innovative pollution prevention to be successful, there must be effective integration of efforts and approaches between all relevant governmental jurisdictions. Without such coordinated efforts, each level of government, or each affected geographical jurisdiction, would essentially hold veto power over any agreement to try an innovative approach, if such changes as extension of normal compliance deadlines or alternative allocation of enforcement penalties would be required. Moreover, support systems will be needed for compliance personnel involved with innovative technologies (see subrecommendation 4.2).

Recommendation 4:

Support regulators and other involved communities to maximize the effectiveness of improvements recommended in permitting and compliance systems.

4.1 Institute a system of incentives, training, and support to retain experienced state and federal permit writers who participate in permitting decisions involving the testing or early commercial use of innovative environmental technologies.

4.2 Institute a system of incentives, training, and support to retain experienced state and federal inspectors and compliance staff who participate in decisions involving innovative environmental technologies.

4.3 Provide support to prospective innovative technology permittees (including technology developers and technology users).

4.4 Emphasize the role of EPA's Office of Research and Development (ORD) as consultant to federal, state, and local government permit writers and inspectors to provide information on innovative technologies for environmental purposes.

4.5 Institute systems to provide the public with information and support related to the testing and use of innovative environmental technology.

4.1 Institute a system of incentives, training, and support to retain experienced state and federal permit writers who participate in permitting decisions involving the testing or early commercial use of innovative environmental technologies.

Commentary

The TIE Committee recommends that a systematic program be instituted for the purpose of retaining experienced permit writers, and to encourage, support, reward, and train those permit writers to be better prepared, and more favorably disposed, to processing permits involving testing and/or introduction of innovative technology. Both increased continuity and specialized support and training are critical to the success of permitting systems to encourage testing and implementation of new technologies because, at present, there is little or no incentive for permit writers (who often have limited experience) to take the risk of recommending or authorizing testing or use of a new technology.

a. THE IMPORTANCE OF RETAINING PERMIT WRITERS: *The TIE Committee believes that improving the continuity of permit writers would be an important step towards ensuring the timely and consistent permitting of innovative environmental technologies.* The Committee heard evidence of cases where, in attempting to permit a new technology, technology developers had to deal with a seemingly constant stream of new permit writers. All of the hard-won verbal agreements that were reached with the old permit writer were wiped clean when the new permit writer came on board and the developers had to start at square one again. Other developers presented case studies of how the rapid turnover rate of permit writers had protracted the permitting of a new technology to such a degree that the expected market niche disappeared by the time the technology finally received permits. Regulatory agencies indicated that the turnover rate problem damaged their ability to consider permit applications on a timely basis, both in terms of the adequacy of staff and the adequacy of their knowledge base.

b. ENCOURAGING FEDERAL AND STATE PERMIT WRITERS: Comments heard during the Fact Finding meetings indicated, however, beyond the issue of experience, that permit writers are often discouraged, by unwritten policy, by the lack of guidance, or by other factors, from writing permits for testing and/or implementation of new technology. The results were often counterproductive to the development and use of innovative technology. For example, in those cases where RCRA permits were entertained for testing new technology, the regulators pushed for full permitting -- e.g., for RCRA technology testing, essentially a complete Part B -- that limited testers' ability to define performance envelopes, restricting the value of testing and increasing its cost. *This situation must be reversed, so that permit writers are encouraged to and rewarded for issuing permits for safe testing of innovative technology for environmental purposes.*

It should be noted that changes at the federal level will have little actual impact if there are not corresponding changes in state programs. State laws and regulations for the various programs are generally modelled on those of EPA -- but there can be significant differences, such as California's "permit by rule" for mobile treatment units for treating non-RCRA wastes. Permit writers in state programs will also have to be brought into the incentives "loop." State and local participation in the permit team strategy outlined in subrecommendation 2.3 should be encouraged.

c. INCENTIVES SUPPORTING PERMIT WRITERS: As one possible model of an incentives program aimed at encouraging, supporting, and training permit writers at federal, state, and local agencies, *the TIE Committee recommends the following*:

1. *Establish a hierarchy or job ladder for permit writers and incorporate criteria in performance evaluations along that promotional ladder to address the permit writers' development of expertise (either single media, cross-media, or technology-specific).* The ladder might include the following elements:

   - Single-media permit writers. Single media permit writers should be networked to facilitate information sharing within regions. These media representatives could serve as team members on the coordinated permit review teams described in subrecommendation 2.3.

   - National expert single-media permit writers. A national expert permit writer program could be established within each of the single media areas as a next step in the ladder. National single-media experts could serve as a nationwide information (both technical and regulatory) resource locus in dealing with innovative technologies. They would also provide institutional memory in cases where local conditions favor high turnover rates. (State experts might also be eligible for this program.)

   - Cross-media permitting experts within each region. A rung in the ladder could be for permit writers who obtain expertise across the media. In designing the cross-media permit expert role, much use could be made of the experience gained in current EPA and state (e.g., Massachusetts, New Jersey) cross-media inspection and integrated permitting pilot projects. Team leaders for the coordinated permit reviews discussed in subrecommendation 2.3 should be drawn from this pool.

   - Regional liaison permit writers. Regional liaison permit writers would serve as coordinators, facilitating access to regional and state single-media and cross-media expertise.

2. *Provide training and model templates, based on the prior testing of innovative technologies, to all permit writers.* A concise, yet comprehensive, training program should explain the permit writers' role in fostering the successful use of innovative technologies for environmental purposes and on information sources and networks for identifying technical information. The training program should also educate the regulators on how industry innovation works, and on the role of ORD and technology groups within other federal agencies, with the goal of improving the permit writers potential networking base for technical information.

3. *Strengthen ORD's role as identifier and conveyer of technical information to permit writers.* Establish a centralized clearinghouse where permit writers can easily access needed information. ORD should help permit writers sift through the technical details of newly proposed technologies, explaining how, and if, the innovation will be beneficial, and under what conditions, and help the permit writer frame permit conditions for unfamiliar technologies. ORD might also be the Agency lead for the ombudsman function (see subrecommendations 1.3 and 4.4).

4. *Establish performance evaluation standards and reward systems that promote greater support and consideration from permit writers for innovative pollution prevention and pollution control technologies.* The first step, as mentioned elsewhere throughout this report, would be develop a clear, strong policy statement about EPA's role in promoting technology innovation. Other steps could include modifying performance standards and credits ("bean counting") to reflect the degree to which a permit writer works to achieve the goals set forth in the technology innovation policy statement. The TIE Committee recognizes that extra time and risk are involved in processing permit applications for innovative alternatives, and for the risk associated with supporting approaches which involve the uncertainties in changes in standard technologies and the uncertainties in performance projections for innovative solutions. Financial incentives should also be considered, as well as recognition and merit awards.

5. *Improve data and technical information sources to aid permit writers in their job of reviewing permit applications involving innovative technologies, perhaps through an expansion of the "ATTIC" data base, which now contains information about innovative remediation technologies.* EPA should collect the information from federal, state, and other sources and assemble the data and information in on-line databases for PC/Mac users. Information should be collected and assembled in information retrieval systems easily accessible to all permit writers. Information should include the following:

   - Media affected by the technology
   - Emission/effluent/hazardous waste reductions achieved by the technology
   - Process descriptions
   - Location and results of tests, demonstrations, and early commercial uses
   - Level of cleanup (remedial technologies) achieved
   - Contact persons, including owner or licensee, plus ORD technical experts
   - Existence of patent covering the technology and the availability of licenses
   - Key words; similar technologies; terms of art
   - Known limitations
   - Potential site incompatibilities.

4.2 Institute a system of incentives, training, and support to retain experienced state and federal inspectors and compliance staff who participate in decisions involving innovative environmental technologies.

Commentary

The TIE Committee recognizes that the need to both maintain continuity of personnel and promote a more positive approach to innovative environmental technology applies to inspectors and compliance staff, as well as to permit writers. *As a result, the TIE Committee recommends that measures to train and support compliance and inspection personnel be undertaken by EPA and the states.*

a. THE SUPPORT ROLE OF FEDERAL AND STATE COMPLIANCE POLICIES: *If EPA and state agency compliance staffs and their respective compliance policies are not supportive of measures to promote innovation in pollution prevention or pollution control technology, compliance requirements will remain a barrier to efforts to innovate.* The Committee therefore recommends that EPA open discussions with state enforcement officials on how best to promote such changes. Some state programs (e.g., New Jersey and Massachusetts) are already in the first stages of implementing compliance programs to promote multi-media pollution prevention. *The Committee also recommends that EPA provide support for evaluation, implementation and expansion of existing state efforts, and for communication between the states on the success of alternative approaches.* Coordination with state efforts to implement HSWA land disposal phaseout provisions consistent with their SARA corrective action plan responsibilities are of particular importance from a technological perspective.

b. THE NEED TO REFORM REWARD PRACTICES: Standard bean-counting approaches to measuring the performance of inspection and enforcement officials are a disincentive for these officials to support innovative responses to compliance requirements. Few compliance officials have experience with multi-media approaches to evaluating facility compliance options. In addition, working with facilities with the opportunity to develop or implement innovative alternatives presents potential significant risks and few potential rewards for the compliance official. Reviewing an innovative approach, or working with a facility to develop such an approach, is almost certain to require more time than imposing a standard compliance requirement and may involve increased scrutiny by managers. Evaluation of an innovative approach is intrinsically more difficult, since operational capabilities and parameters are generally more uncertain than standard alternatives, whether for innovative manufacturing evolutions or innovative pollution control methods. This poses the risk that the compliance official will be held responsible for blessing an alternative that fails.

c. ELEMENTS OF A SUPPPORT SYSTEM FOR COMPLIANCE PERSONNEL: *If compliance officials are to be willing to undertake the greater difficulties posed by innovative alternatives, there must be clear policy direction, support, and rewards for their efforts. Three mutually reinforcing elements are key:*

1. *First and foremost, EPA or the relevant state agency must have articulated a compliance policy which clearly establishes promotion of environmentally beneficial innovation as a major goal*. Once such a clear policy is established, many of the necessary tools are available. For example, the Agency could implement more effectively the innovation waiver tools which it has largely neglected in the past. The TIE Committee reiterates its January 1990 recommendation (1.4.h) that EPA expand the use of existing statutory provisions

which trade compliance delays for improvements in technology (e.g., CWA Sections 301(k) and 301(n); CAA Sections 111(j) and 113(d)). The Office of Water has plans to draft revised guidance for the Section 301(k) waiver process, but in most cases the authorities carry little practical guidance and are seldom used. (See a further discussion of waivers under subrecommendations 2.1 and 3.3.) The *Enforcement in the 1990s Project* describes several innovative enforcement approaches that the Committee believes are compatible with the greater risk-taking necessary to encourage technological innovation.

2. *Second, the performance evaluation and reward system must be amended to provide special credit for the compliance official who takes the risk of seriously evaluating and encouraging such approaches*.

3. *Third, in order to promote attention by compliance officials to innovative technology alternatives and to promote the retention of inspectors and compliance staff knowledgeable of and favorably disposed to considering the use of innovative technologies, the TIE Committee recommends a parallel incentives program to that outlined above for permit writers*. The major headings below identify the basic program content (see subrecommendation 4.1 for details):

   - *Establish a hierarchy or job ladder for compliance staffs and incorporate criteria in performance evaluations along that promotional ladder to address the staffs' development of expertise (either single media, cross-media, or technology-specific).*

   - *Provide training and model templates, based on the prior testing of innovative technologies, to all compliance personnel.* Such training should include explanation of the role of inspectors and compliance staff in promoting technology innovation for environmental purposes.

   - *Strengthen ORD's role as identifier and conveyer of technical information to compliance personnel.*

   - *Improve data and technical information sources to aid compliance personnel in compliance situations involving innovative technologies.*

4.3 Provide support to prospective innovative technology permittees (including technology developers and technology users).

Commentary

The TIE Committee has previously recommended (January 1990, recommendations 1.2 and 1.7) that the Agency should build into its technology innovation promotion strategies comprehensive approaches to inform regulated parties, particularly small and medium-sized businesses, about (a) applicable environmental requirements; (b) the advantages of developing and using innovative technologies to meet these requirements;

and (c) EPA's specific programs to foster innovative problem solving. The current recommendation builds on the January 1990 recommendations and provides some concrete details on possible informational approaches, some of which are being used today and all of which can be put to greater use in cost-effective fashion. Many of the support functions for prospective permittees which follow might be carried out by the "technology advocate" (see 1.3 and 4.4). These functions include the following:

1. Outreach seminars on innovative technology permit and compliance policies and processes.

2. Information dissemination programs related to innovative technologies. These can involve coordinated efforts by EPA offices (especially ORD [see January 1990 recommendation 1.5.b]), industry associations, state agencies, economic development authorities, local authorities, professional associations, and others. Opportunities to assist executive branch organizations and non-governmental organizations inform their memberships have particular potential. Examples of potential dissemination mechanisms are:

    - Newsletters
    - Press releases
    - Reports
    - Seminars.

3. Access to the on-line database to be developed under subrecommendation 4.1 (item 9). Additional information relevant to technology users and potential permittees might be added to the database, including permit requirements used in similar technologies and other permit application informational needs. Technical information might also be added to the RCRA/CERCLA "Hotline." Similar mechanisms could also be found for water and air. Consideration should be given to enlisting the cooperation of a private service (e.g., DIALOG) to ensure wide access to the information. Among the advantages of an environmental technology clearinghouse are that it would help innovators track the state of the art and it would promote selection of appropriate technologies and invention of new ones.

4. Utilization of ORD personnel for technical assistance and subsidized testing. This would coincide with establishing an ombudsman function, as described in subrecommendations 1.3. and 4.4. Subsidized testing should be increased, although note should be taken of the January 1990 recommendation 1.5.a, which calls for expanding testing protocols in the SITE program and analogous testing efforts to define performance envelopes.

5. Assure that the confidentiality of applicants' trade secrets is maintained. The TIE Committee notes that the statutory language for trade secret protection varies from statute to statue in terms of the procedure for asserting trade secrets. This can create confusion among technology owners, licensees, and users, and complicates the role of permit writers and compliance personnel involved in the consideration of tests and uses of innovative technologies. Trade secret protection information and procedures should be readily available, and to the extent that there are substantive differences among the environmental media statutes, these should be normalized.

4.4 Emphasize the role of EPA's Office of Research and Development (ORD) as consultant to federal, state, and local government permit writers and inspectors to provide information on innovative technologies for environmental purposes.

Commentary

The TIE Committee reiterates its previous recommendation (January 1990 TIE Recommendation 1.5.b) that the Agency should investigate ways to strengthen ORD's roles in fostering technology innovation as (a) identifier and conveyer, with the regulatory offices, of information about present and future technology gaps; and (b) a non-regulatory forum that works closely with technology user communities, as in the SITE program, to evaluate and guide technology development efforts. An analogous role for ORD within the federal government, the need for which has become more prominent, is to maximize the flow of environmental technical information among all parts of the government, including the Departments of Energy and Defense and the national laboratories.

a. "TECHNOLOGY ADVOCATE": *Subrecommendation 1.3 calls for EPA to consider establishing a "technology advocate."* Its function would provide a single point of contact for technology developers, prospective users of innovative technology, permit writers and compliance officers at all levels of government, and the public so that people can find out information about:

1. The policies relating to technology innovation
2. Permitting processes relevant to proposed tests, demonstrations, or uses of an innovative technology
3. The status of permit applications -- for individual tests and demonstrations, testing centers, and early commercial uses -- at both federal and state agencies
4. The results of tests, demonstrations, and early commercial uses of innovative technologies, including information about the performance envelopes of individual technologies.

The function could also profitably include the ability to intervene to encourage timely consideration of permit applications or even to mediate between permit applicant and permit writer.

Currently, the EPA office most closely matching the requirements for the ombudsman role is ORD. ORD has strengths in its knowledge of and objectivity about technology, and in its multi-media orientation, and would need to strengthen its knowledge with respect to permit processes and permit status.

b. ORD ROLE WITH PERMIT TEAMS: *ORD also should play a complementary and significant role in the permit team concept propounded in subrecommendations 1.3 and 2.3.* Other roles for ORD in fostering technology innovation in this document include (a) developer of guidance documents on permitting technology testing centers and (b) collator of information (e.g., clearinghouses, on-line databases) discussed under incentives for permit writers and compliance staff (subrecommendations 4.1 and 4.2). These roles should be made prominent within the ORD system and integrated with existing technology transfer and regional scientist processes.

4.5 Institute systems to provide the public with information and support related to the testing and use of innovative environmental technology.

Commentary

The Committee believes that one of the most significant barriers to implementation of innovative environmental technology is lack of public trust in the information presented during the permitting process, as well as in the actual process of permit review and approval. As a result, siting of new facilities, or use of new technologies in existing facilities, often faces insurmountable public resistance.

a. THE NEED FOR AN EARLY, SUBSTANTIVE ROLE FOR THE PUBLIC WITH RESPECT TO INNOVATION: The public concern and fear of things that are new, whether associated with innovative technology or not, must be understood and addressed. It is important to realize that no study can prove the absence of an adverse effect. Every effort must be made to supply the public with as much data as is available (with understandable explanatory information) and to involve the public in the permitting process as early as possible. If this is done, by the time permits are issued for a facility it may not seem as "strange" or "new" but, in fact, very familiar. In addition, for this reason, care should be taken in the permitting processes with the designation "new", whether with reference to entire facilities, production processes, or changes to facilities and processes.

b. STEPS FOR PUBLIC PARTICIPATION: *The Committee recommends two measures which EPA should undertake to improve the quality of public participation in permitting.* Implementing these measures may involve statutory, as well as administrative, changes:

1. *Provide detailed information on all facets of a new technology for which a permit is sought, and provide (or require the applicant to provide) substantial information on all known risk factors relevant to any permit application.*

2. *Redesign permitting processes to afford the public an early and more substantive role in the actual design requirements for facilities that affect them.* An improved use of public hearings should be considered, but it should be noted that public involvement can occur in other ways, as well.

c. TECHNICAL SUPPORT TO LOCAL COMMUNITIES: One way would be to address the limited resources available to communities that are wrestling with the problem of how to respond to proposals for environmental compliance made by local regulated organizations. In particular, communities find it difficult to obtain adequate technical expertise to assist the community in evaluating the potential contribution of a new technology and in developing a confident understanding of the level of safety being provided. Communities often lack knowledge about the regulatory and administrative processes associated with innovative technologies.

Environmental policy makers must consider how to provide neutral technological and regulatory process advice beyond that provided by the regulated organization involved or the governmental authorities who must approve permits. The Committee notes that some communities are now entering into agreements to purchase neutral expert advice, using funds provided by the regulated organization and, in some cases by governmental units. EPA, for instance, can provide such support under the "Technical Assistance Grant" authority of CERCLA (Superfund). Such community-chosen experts may provide the confidence bridge necessary for having a fair and equitable decision making process. The Committee suggests that environmental policy makers consider how to make it possible for local communities to obtain such neutral advice as a matter of routine and on demand, whenever the use of an innovative technology for environmental purposes is proposed. One suggestion to this end is that EPA consider the idea that an independent foundation be established, with partial government funding, to provide communities with access to independent expert technical and process support.

d. THE TWO-TIERED PERMIT PROCESS: *The two-tiered permitting process recommended earlier could help achieve positive public involvement.* Under such a process (see subrecommendation 2.2), phase one -- a screening step -- would consider the basic principles and parameters for a potential facility permit, and phase two -- the detailed consideration step -- would weigh detailed technical information and result in the issuance or denial of permits. Phase two would commence on if issues identified in the phase one have been resolved.

The public would be involved deeply in each phase. Use of the two-tiered process could reduce the time and investment required to explore permits for innovative technologies, either by identifying and resolving basic issues (e.g., characterization of wastes produced, environmental and health risks, and process efficiency) early in the process, or by reaching the point during phase one that no agreement is possible. In this latter case, public input to the project could be made earlier, and the project modified or abandoned before regulators, applicants, and the public have expended as much time and resources as they would have to if a complete permit application has to be provided. Importantly, by involving the public in the process early and in a substantive way, the two-tiered process allows all parties to build the confidence necessary for a successful dialogue.

Recommendation 5:

Identify and remove regulatory obstacles which create unnecessary inflexibility and uncertainty or otherwise inhibit technology innovation for environmental purposes. Among these are:

5.1 The Administrator should consider seeking statutory authority allowing EPA to develop an efficient regulatory mechanism under RCRA Subtitle C for making determinations about the effectiveness of technologies to render wastes not hazardous.

5.2 The Administrator should clarify a number of definitions of terms of art under RCRA.

5.3 The Administrator should consider statutory and regulatory revisions to provide that RCRA land ban treatment standards based on incineration as BDAT need not automatically be applied to all site remediation technologies.

During the course of its discussions, the Committee noted several regulatory glitches that appear to inhibit the development of innovative pollution control or pollution prevention technologies. What is referred to here are specific regulatory requirements, rather than the fundamental, best available technology based regulations themselves.

The Committee did not undertake a systematic effort to seek out and analyze these glitches, but found examples associated with each media statute. The innovative technology waiver programs under the Clean Air Act and the Clean Water Act, for example, are not functional. The absence of functioning processes for this purpose represents a significant difficulty to the innovation process and, hence, the designation of these by the Committee as "regulatory glitches." Similarly, the Committee suggests that the Agency review standards. If the Committee's fact finding processes and discussions were in any way indicative, however, the problem of regulatory glitches is most acute under RCRA-derived programs.

The Committee recommends that the Administrator undertake a more systematic identification and review of such problems. The recommendations below are neither in order of priority nor in any way complete.

5.1 The Administrator should consider seeking statutory authority allowing EPA to develop an efficient regulatory mechanism under RCRA Subtitle C for making determinations about the effectiveness of technologies to render wastes not hazardous.

Commentary

The current site-specific delisting process under RCRA Subtitle C is complex, time-consuming, costly, and greatly discourages technology innovation for environmental purposes. This process takes 1 to 2 years and accomplishes delistings through rulemakings. The Committee recommends development of a regulatory mechanism to allow the Agency to conduct vendor-specific reviews of a technology to determine whether the technology, when applied to a specific waste(s), renders it non-hazardous. The Committee suggests that such a mechanism have a post-treatment verification system to assure that the waste was, in fact, entitled to delisting.

The Committee is aware that EPA is considering approaches to specify, through a rulemaking, certain minimum hazardous constituent concentration levels below which wastes would no longer be hazardous, i.e., *de minimus* levels. Technologies which could demonstrate that they reduce concentrations of hazardous constituents below these levels could then be marketed with more certainty as to their applicability and benefit to users. A *de minimus* approach could be simpler, since it would not require Agency review of individual technologies. The Committee did not specifically review this concept, but believes that it may accomplish some of the objectives it recommends.

However it is accomplished, an improved delisting process would allow technology developers to better market their products, since it is important for them to be able to assure potential technology users that, under specified conditions, their treatment technology will produce a delistable waste.

5.2 The Administrator should clarify a number of definitions of terms of art under RCRA.

Commentary

Definitions of what constitutes "recycling" and "reuse," and the impacts of regulatory concepts such as the "derived-from" rule, have potentially significant implications for technology innovation. *While the Agency has been constrained in its evaluations of such impacts by statutory requirements and court interpretations, the Committee recommends that -- given the potential for modifying such definitions in the pending RCRA reauthorization -- the Agency undertake a more comprehensive review looking at the implications for new pollution prevention or control technologies of alternative approaches.* The Committee understands that the recent RCRA Implementation Study recommended that EPA undertake such a review. The Committee endorses this action.

5.3 The Administrator should consider statutory and regulatory revisions to provide that RCRA land ban treatment standards based on incineration as BDAT need not automatically be applied to all site remediation technologies.

Commentary

Existing BDAT standards were established primarily to reflect the chemical and physical properties of newly generated wastes, rather than contaminated soil and debris. As a result, BDAT standards have not necessarily distinguished among technologies that can be applied to contaminants found in a soil matrix and those for which such a matrix provides significant barriers to performance. Such difficulties may be particularly significant in situations where current BDATs require incineration of large quantities of soil or debris that contain low concentrations of contaminants. The Administrator should address this problem by developing alternative BDATs specifically designed for soils and debris-type waste that is generated during remediation and that has low contamination levels (i.e., not "hot spots" or wastes segregated in barrels).

The Committee takes note that this is a complex, dynamic regulatory area. The RCRA Implementation Study has made recommendations and the Office of Solid Waste is working on BDAT for soil and debris. EPA has proposed that contaminated media be handled differently from new RCRA wastes, but has not finalized new rules. EPA should conclude that rulemaking. In doing so, the Committee hopes that EPA will develop a principled basis for setting BDAT at other than incineration.

APPENDIX 1

Names	Company/Organization
Expert Presentations:	
January 27 at the first Focus Group meeting (oral presentations):	
Elizabeth Cotsworth	EPA Office of Solid Waste
Ephraim King	EPA Office of Water Enforcement and Permits
Gary McCutcheon	EPA Office of Air Quality Planning and Standards
March 15 at the second Focus Group meeting (oral presentation):	
Dr. Manik Roy	Mass. Dept. of Environmental Protection
May 16 public fact finding meeting in San Francisco (oral presentations):	
Don Haney	IT Corporation
Robert Keefer	Enviroquest
George Lane/Frank Dixon	Thermal Waste Management
David Leu	Mittelhauser Corp.
Dave Morell	Epics International
Peter Venturini	California Air Resources Board
Jeff Wiegand	Alton Geoscience
Region IX Panel:	
Marsha Harris	EPA Region IX
Gene Herson; Maggie Johnson; Cedar Kehoe	Sanitary Fill Company
Bill Lee	City/County San Francisco
Submitted papers:	
Terry Galloway	Synthetica
James Allen	CA Alternative Technology (CA Dept. of Health and Services)
August 8 public fact finding meeting in Washington, D.C. (oral presentations):	
Jim Cummings	EPA/OSWER/Tech. Innov. Office
Bill Arble	PENNTAP
Ken Hagg	Mass. DEP
Janet Friday	AER*X, Inc.
Dave Lachapelle	EPA/ORD/Air and Energy Engineering Research Laboratory
Don Currier	Custom Recovery Services
Larry McGeehan	NETAC
Mahesh Podar & Deb Hanlon	EPA/OPPE
Ben Simmons	ETICAM, Inc.
Paul Wilkinson	American Gas Association
Bob Olexsey	EPA/ORD/Risk Reduction Engineering Laboratory (RREL), Cincinnati, OH
Frank Freestone	EPA/ORD/RREL/Edison, N.J.
Peter Daley	Chemical Waste Management, Inc.
Frances H. Irwin	Conservation Foundation
Jack Taylor	Virginia Power Companies

August 8 Presenters (continued):

Alfred Slowik	Pennsylvania Electric Company
Frank Partee	Ford Motor Company
David W. Patti	PA Chem. Industry Council
Richard Fortuna	Haz. Waste Treatment Council
Dave Fagan	EPA/OSWER/OSW

Submitted papers:

J. Kenneth Wittle	Electro-Pyrolysis, Inc.
Debora Mitchell Sparks	AMOCO Corp.
John J. Trela	N.J. DEP

Meetings included:

September 18 meeting with representatives of the State of California. The following individuals participated:

Jesse Diaz	Chief, Division of Water Quality Water Resources Board
Raymond Menebroker	Branch Chief, Stationary Source Division, Air Resources Board
Bernie Vlack	Chief, Enforcement Waste Management Board
Dr. James Allen	Chief, Toxics Substance Control Alternative Technology Division Department of Health Services
Alan Ingham	Senior Waste Management Engineer Toxic Substance Control Division Department of Health Services

June 25 meeting sponsored by the New Jersey Institute of Technology on technology for treating hazardous waste. Participants included NJIT, N.J. Dept. of Environmental Protection, US EPA Hazardous Waste Engineering Research Lab, US Army, and 24 regulated companies, some of which develop their own technologies.

Individuals conferred with included:

Fred Lindsay	Director, Office of Environmental Engineering and Technology Demo., ORD
Dag Syrrist	Vice President, Technology Funding, Inc. 2000 Alameda de las Pulgas San Mateo, CA

Correspondence:

Samuel Goldberg	President, INCO
Mike Bellivan	Program Director Citizens for a Better Environment

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16. Abstract (Limit: 200 words)

The United States' potential to improve the environment is directly related to the nation's ability to produce and apply technological solutions. The Technology Innovation and Economics (TIE) Committee, a standing committee of EPA's National Advisory Council for Environmental Policy and Technology (NACEPT), concluded that the barriers in federal and state environmental permitting and compliance policies are slowing technology innovation for environmental purposes. This extensive study, involving technology developers, technology users, financiers, regulators, environmental groups, and academia, determined the range of impacts and identified the range and practicality of potential solutions. The report captures the Committee's analysis of six critical policy issues and the key parameters affecting the design of permitting and compliance systems. It recommends five major areas for improvement, including:

1. Modifying permitting systems to aid the development and testing of innovative environmental technologies
2. Implementing permit processes to aid the commercial introduction of innovative technologies
3. Encouraging the use of innovative environmental technologies in compliance programs
4. Maximizing the effectiveness of permitting and compliance improvements by supporting stakeholders
5. Identifying and removing regulatory obstacles inhibiting innovative technologies for environmental purposes.

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16. (Cont'd) Abstract

The report concludes that fundamental changes to the environmental regulatory system will also be needed to create incentives encouraging the process of technology innovation.